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Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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National Electricity Supply.

AT last we have before us the Electricity (Supply) Bill, 1926, which is to bring about a new era in the history of the electrical industry in this country, and thereby to assist in restoring prosperity to the whole community. As we have previously indicated—and as Mr. Stanley Baldwin himself admitted in his forecast of the measure—a cheap supply of electricity in itself is not a panacea for our industrial disorders; but that it should, and will, play a leading part in re-building our constitution and hastening the return of healthy conditions we have no doubt whatever, provided that its development and use are cultivated on sound commercial lines. Preliminary utterances on the part of those acquainted with the proposals that were laid before the Government led us to fear that costly enterprises would be undertaken which, however advantageous they might prove to the next generation, held out no prospect of material benefit in the immediate future, and our fears were shared by many prominent members of the electrical profession; we are glad, therefore, to find that the reality is less alarming than the anticipation. In many respects the provisions of the Bill are admirably conceived, and may be cordially welcomed, though there are certain features which will require the most careful and critical examination. That this will not be lacking is evidenced by the Prime Minister's desire to obtain the second reading before Easter, so that there may be ample time for the detailed investigation of the proposals in Committee which he clearly foresees.

The outstanding feature of the Bill is the creation of a "Central Electricity Board" for the whole country, whose principal function is to buy and sell electricity on the most advantageous terms; to enable it to do this effectively, it is to be empowered to exercise complete control over the generation of electricity at certain "selected" stations, which must either be extended by the owners to comply with its requirements or sold outright to the Board. The owners of stations who consider the Board's requirements "unreasonable" are granted the right of appeal not only to the Electricity Commissioners, but, in this case only, beyond them to the Railway and Canal Commission. New stations will be erected by arrangement with the Board, or if this cannot be done, the Board will take the matter into its own hands; but in any case, the Board is not to operate any station, new or old, unless there is no alternative.

Having at command an unlimited supply of electricity, the Board must provide facilities for retailing it; for this purpose it is to prepare a scheme, and after it has been confirmed "as respects any area," to construct transmission lines connecting the "selected stations with one another and with the systems of authorised undertakers in accordance with the scheme *so far as it relates to that area.*" That is entirely commendable. The words which we have italicised imply that the crude idea of covering the country with a "gridiron" of high-pressure mains, as a first step towards cheapening electricity (save the mark!), put forward by Lord Weir's Committee, has been prudently pigeon-holed, and that area development on normal lines has taken its place—for which relief we are grateful. The same inference can be drawn from the clause regarding the standardisation of frequency, which is permissive only, and says that the Board "may require" undertakers to alter the frequency "if and so far as such alteration is required" under the scheme, or to effect such standardisation as it "may think expedient." There will not, then, be a storm of standardisation to afflict the country, at a time when economy is a first necessity—be it remembered that the abolition of the frequencies of 25 and 40 cycles is needed solely for the purpose of interconnection, and that the outlay is wholly unremunerative in itself. Further discussion of that question must be deferred for the moment.

Our next point concerns the sale of the electrical energy thus obtained and distributed to authorised undertakers. The latter need not take it if they can generate more cheaply themselves, and thus the interests of consumers are safeguarded in areas already enjoying a cheap supply—cheaper, in some cases, than the Board can hope to offer. The owners of the "selected" stations appear to be at a disadvantage, in that they have to sell to the Board the whole of their output at the cost of production, and repurchase energy for their own undertakings at a price which appears almost certain to be higher, for it has to bear "a proper proportion of the Board's expenses"; alternatively, the price is the Board's general tariff, which is framed to cover its expenditure plus capital charges, with a margin. The conclusion seems inevitable that the cost will be increased—unless an improved load factor results from the operations of the Board, more than sufficient to wipe out the additional burdens. To soothe the owners' natural apprehensions, they are protected for the first seven years against paying more than the cost that they would have incurred without the Board's assistance.

That such an improvement in load factor will be obtained is the argument that has been put forward to justify the adoption of this "middle-man" system. We sincerely hope that it will prove well-founded, though there is little evidence before us to that effect. The success of the scheme is largely dependent upon this consideration. It is a case of "making the best of a bad job." Because past legislation has thrown electricity supply mainly into the hands of local authorities, amalgamation of the distributors, which would have been possible if they had been companies, cannot be effected; nor will the local authorities permit companies to take over their undertakings. Had the conditions been otherwise, companies could have been formed to generate electricity in large power stations, transmit it to the various townships, and distribute it to the consumers, without any middleman. This would have been the most satisfactory and business-like method of dealing with the problem, and is not only in full force abroad, but is also practised in this country most successfully by such power companies as have been able to come to terms with the local authorities in their areas.

An important provision is that which enables the Electricity Commissioners to require undertakers who refuse a supply in bulk from the Board to reduce their charges to consumers by the amount by which their cost of production exceeds the bulk price offered by the Board. This should result in the closing of inefficient generating stations, as the alternative, in the case of a municipality, is a call upon the rates; the case of a company does not arise, as no company would refuse a cheap bulk supply.

The Central Electricity Board is to be deemed to be an "authorised undertaker" within the meaning of the Electricity Acts in many respects, but will also fill the office of a "super" Joint Electricity Authority, with all Britain for its District, as we surmised in our issue of January 29th. So far as it follows the policy of developing electricity supply in the existing Districts it will be working on the lines which we have advocated. It is not clear, however, that it is under any obligation to extend the supply into areas at present unprovided with electricity—yet it appears that the rural demand is largely relied upon to improve the load curve and to produce the resulting economies which are to pay for interconnecting mains, the standardisation of frequency, and the expenses of the Board. The scheme is incomplete, and the Bill will probably emerge from Committee materially changed from its present aspect. Whilst there are many points in it which we have not here touched upon, such as the nature, constitution and authority of the Board, a matter which is giving rise to criticisms in important quarters, there are also serious omissions, and we especially regret that neither railway electrification nor the question of improved facilities for wayleaves is so much as mentioned in the Bill.

The South American Market.

In this issue we review two reports issued by the Department of Overseas Trade, both relating to South American countries. In the search for new outlets for our goods and the endeavour to strengthen established trade relations, there seems to be no doubt that, apart from the British Dominions, Latin America is the market which should receive the closest attention.

Argentina is an old and important customer for British goods, but it is not sufficient to rely on this fact to sell more of our products. Competition is very keen—keen enough to overcome all sentimental attachments, and if we are to retain and strengthen our connection with Argentina, continued study of the country and its people is essential. For this reason we welcome Mr. Chalkley's report, which brings before British traders some ideas and suggestions for meeting the competition of United States and Continental producers. In some respects the market is an easy one; Argentina is one of the countries which, being least hit by the war, was able to recover sooner, and the knotty problem of long-term credits is not met with there. In the electrical branch, in particular, Great Britain is not unfavourably placed, and in two of the main sections supplied more in 1924 than in the preceding year.

With regard to Brazil, the position is not so satisfactory. There the price factor appears to be more in evidence, and although the sterling merits of British goods are recognised, they are hard put to it to combat the competition of Continental products. The existing conditions in Brazil also raise the question of long credits. One important matter mentioned by Mr. Hambloch is the fact that the most important contracts emanate from the Federal and State Governments and municipal authorities. It is pointed out that unless a firm has an agent on the spot, such opportunities are almost certain to be lost. It is stated that at present Great Britain supplies only about 14 per cent. of the electrical goods which Brazil imports, but intense American and German competition has to be dealt with if this quota is to be increased.

Bringing Electricity Within Reach.

Although of some importance from its position in the Port of London, as well as from an industrial point of view, Gravesend is a modest town, and does not often figure in the newspapers. Recently, however, it has made a move which should bring it into greater prominence in electrical circles. This is the introduction of a system of charging for electricity which is one of the most favourable to electrical development that we have heard of. It is

a rateable-value tariff requiring the payment in advance of 2½ per cent. of the assessment of premises per quarter, the "unit" charge being ¾d. To realise the value of the new system, it has to be borne in mind that it is an "overall" method of charging for lighting, heating, cooking, &c., and there are no conditions as to the use of appliances, &c. So far we have come across only one undertaking with a similar system—Watford—but here the fixed charge of 2½ per cent. only applies during the summer quarters; it rises to 5 per cent. in the winter. The lowest flat rate charge, for heating and cooking only, in the Greater London area (which is fairly representative of the country as a whole) is 1d. per kWh, but the new Gravesend charge beats this when the consumption, in the case of a house with an average assessment, rises above 400 kWh per quarter. The latter figure is easily attainable where heating and cooking are done electrically. In this particular town the price of gas is very high, and if the new electricity tariff is given sufficient publicity—backed up by demonstrations of cooking, &c.—the Electricity Department should be overwhelmed with applications for supply. Plant extensions are already in hand, and more should soon be required. We congratulate the Gravesend Electricity Committee and its engineer (Mr. C. F. McInnes) upon their determination to provide a really "cheap and abundant supply" of electricity, and call upon other undertakings to take a similar forward step. We have always said that it could be done, and we are confident that the policy will be justified by the results.

The North-East Coast Counties.

In our series of maps showing the present position of electricity supply in this country, this week we reach the counties of Northumberland and Durham, which include almost (but not quite) the whole of the area served by the Newcastle-on-Tyne and Associated Companies. This is of exceptional interest at this time, when the Electricity (Supply) Bill is before the House of Commons, for it is an example of the development which can be brought about by the operations of companies endowed with wide powers over large areas. As we point out in our leading article, co-ordination of this type is not practicable where the business is in the hands of municipal authorities. In this area the annual consumption of electricity is about 500 kWh per head of population; in the Metropolitan area, in spite of the large demand of the electric railways, the consumption is less than half as much. Until recently the companies in the latter area have been prohibited by Parliament from combining, and thus although they are responsible for two-thirds of the output of electricity, they have been in no better case in this respect than the municipalities. Under the new conditions, amalgamation is rapidly taking place, and we hope in a very few years to see a vast improvement effected in London and the home counties. "Electrical Freedom," the contractors' slogan, might equally serve for the electricity suppliers.

In other districts besides Tyneside, where the power companies have enjoyed a fair degree of freedom, as in Yorkshire, the North Metropolitan Company's area, and on Clydeside, rapid progress has been made.

It will be observed that in the North-Eastern area there are very few power stations; those of the companies are sited on rivers, near the denser loads, and no part of their area is more than about 30 miles from one of them. The North Tees station is, we believe, unique in that it is a non-statutory one, owned by a subsidiary company. The average revenue of the companies, per kWh sold, is about ¾d.

The Report of the Coal Commission.

Last week the voluminous report of the Royal Commission on the Coal Industry was issued, and was received with mixed feelings by those interested in this important subject. The most general impression was that the Report afforded abundant material for thought, and that time was necessary to allow of its digestion before it could be adequately discussed. Certainly our compliments are due to the Commission, which, under the able chairmanship of Sir Herbert Samuel, has carried out a most thorough and impartial investigation into the economic position of the industry and has embodied the fruits of its labours in a treatise of some 300 pages which deserves the highest commendation.

We are glad to find that the Royal Commission definitely turns down the proposal that the mines should be nationalised, and considers that the industry should remain under private enterprise; it recommends, however, that the mineral rights should be acquired by the State and administered by a Coal Commission under the Secretary for Mines. Another important recommendation is that many of the small mining properties should be amalgamated, if possible by voluntary action, but in cases where unreasonable opposition is met with, by compulsory transfer.

Research should be largely extended, and a closer connection between mining and the allied industries is advocated; the Commission holds that the development of electricity supply under the new proposals of the Government should be closely co-ordinated with the generation of electricity at the mines, and proposes the establishment of a National Fuel and Power Committee which should maintain a constant survey of the heat, power, and light requirements of the country.

The most emphatic decision of all is that no further subsidy shall be allotted to the industry, which must stand upon its own economic basis.

Railway Electrification.

An important announcement, which appears to have escaped the attention that it deserves, was made by the Chairman of the Southern Railway in his speech at the annual general meeting—namely, that the overhead contact system on the Central, or Brighton, section of the railway, is to be scrapped, in order to bring that section into line with the Eastern and Western sections, which are both operated with direct current at 600 volts, third rail. While it is undoubtedly awkward to have a non-standard system sandwiched between two which are standard (as recommended by the Advisory Committee of the Ministry of Transport six years ago) we confess to some feeling of dismay that a system which has given satisfaction, which only recently has been considerably extended, and which is similar to that widely adopted in other countries, should be abolished in favour of something not very different from the first efforts in electric traction. We hope it is not to be inferred that the Southern Railway has abandoned all intention to proceed with main-line and long-distance electrification, for to confine electrical operation to suburban traffic would be to derive from it less than half the benefit of which it has been proved capable. As we have pointed out, it is very important that we should have at least one single-phase railway in operation in this country, in order to assist our manufacturers in developing and improving the design of a.c. motors, and we greatly regret the prospect of the adoption of a low-pressure system which, however well adapted for suburban service, is certainly not suitable for main-line operation.

The Report of Lord Weir's Committee.

Simultaneously with the issue of the text of the Electricity (Supply) Bill, the Report of the "Committee appointed to review the national problem of the supply of electrical energy," generally known as the Weir Committee, was published (H.M. Stationery Office, price 2s. net). Although this report was presented to the Minister of Transport on May 20th last year, it has hitherto been withheld from the public, for reasons which may readily be surmised; and in now issuing it, the Minister points out that the Government has not accepted all the proposals of the Committee.

The Report is a very interesting document, and will be reviewed at length in a later issue.

Distilling Plant for Central Stations.

The Kestner Distiller at the Comines (France) Power Station.

By THEODORE RICH.

The question of the use of distillers for boiler-feed work first became a matter of importance in the Navy. The necessity of independence of port water supplies, furthered by the development of the water-tube boiler, made distilling plant a very necessary piece of apparatus in the modern war ship.

Early in the day, when electric power stations began to get out of the *régime* of small belt-driven units, the desirability of good feed water became manifest; nowadays, owing to the increased evaporation per square foot of grate area and heating surface, and the expense and loss of revenue when boilers and economisers have to be laid up for cleaning, let alone the loss of efficiency through the existence of scale and excessive upkeep costs, the necessity for clean and chemically harmless feed water has become more important than ever.

Numerous types of external water-softening and internal deposit-collecting devices have been brought out from time to time, but where the water is really bad, solids usually enter the boiler which are better left outside. At some large installations abroad, for instance at Comines,* distilled water is used not only for boiler purposes, but also for various coolers where a deposit would lead to trouble. It is naturally important that the potential energy in any steam used should be as far as possible utilised. In marine practice, where weight is of great importance, it is usual to evaporate by means of high-pressure steam, which circulates inside tubes bent to a convenient form, the water to be evaporated being outside the tubes; with such a high temperature to start with, the water evaporated per square foot is high, which tends towards the deposition of hard scale; with low-grade steam any deposit on the outside of the tubes is of a soft nature. Further, by the use of high-pressure steam that part of the heat energy in the steam which might have been used for the purpose of running prime movers is lost, and the evaporative capacity of the boilers primarily intended for the generation of power is reduced to that extent. It may be pointed out that this heat if not used for such motive power is not totally lost, as it goes into the water to be evaporated through the distiller tube walls, yet unless the vapour produced is condensed by means of feed-water circulation or similar means by which the heat is recuperated, part of this extra heat will also be lost. A much more efficient system, taken as a whole, is to use bled steam from a turbine or exhaust steam from steam-driven auxiliaries; by this means part of the energy in the steam performs useful mechanical work, the remainder of the heat (with certain small losses) being used for evaporation.

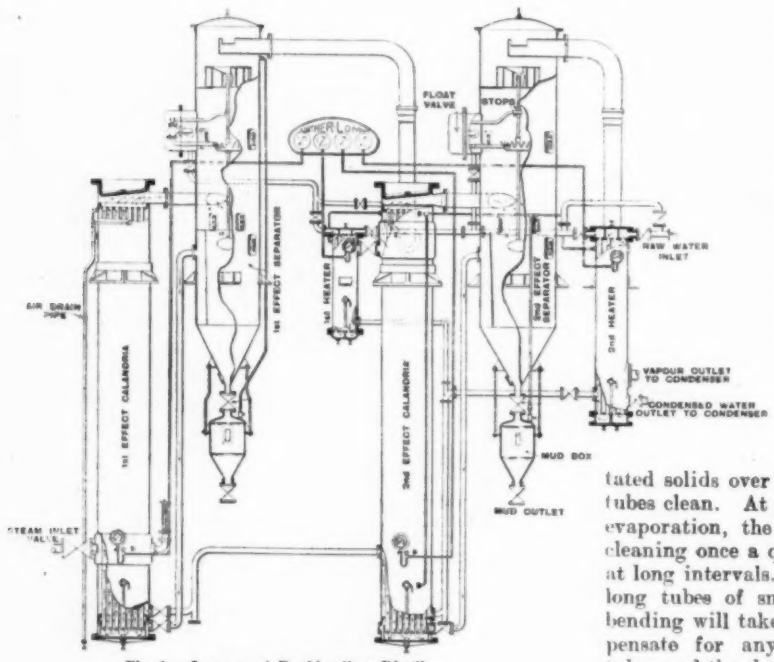


Fig. 1.—Lay-out of Double-effect Distiller.

At Comines the feed pumps are steam turbine driven, the exhaust being turned into the distillers, which are of the Kestner climbing film type. This type of apparatus, which has been used for a number of years for industrial processes, has certain interesting features.

Suppose a long tube in an upright position is jacketed with steam, and water under a low head is introduced into the tube at the bottom; then, provided a certain ratio exists between the length and the diameter of the tubes, the bubbles of vapour as they rise will tend to carry with them a film of liquid up the inner tube walls to the top; if this liquid flows into a separator along with the vapour, the unevaporated water can be returned to the bottom of the tubes again, and an active circulation will be kept up. This is the principle of the Kestner climbing film evaporator. It is found that if vertical tubes 2 inches in diameter and 7 metres between tube plates, about 23 ft. long, are used, a climbing film action will take place under suitable conditions of head. The velocity of the film in the tube is high, and as the film is very thin, the rate of heat transmission is high, and further than this, the high velocity tends to carry the precipitated solids over into the separator, and thus keep the tubes clean. At Comines, where there is multiple effect evaporation, the tubes of the first effect only require cleaning once a quarter, and the remaining effects only at long intervals. There is the further point that with long tubes of small diameter, sufficient bow-shaped bending will take place between the tube plates to compensate for any differences of expansion between the tubes and the shell.

When the latent heat in the water which is evaporated by the primary steam in one set of tubes is used to evaporate water in another set, then we get what is known as double effect, and if this is repeated a second and third time we get what is known as quadruple effect. The advantage of a multiple effect is that much more water can be evaporated per pound of steam used than if a single effect only is adopted. For instance, with quadruple effect about 3.4 lb. of distilled water can be produced for each 1 lb. of exhaust steam from the turbine-driven feed pumps; on triple effect 2.6 to 2.8 lb. is produced, the latter under favourable conditions. At Comines the plant was originally designed to work triple effect with one spare effect, while on emergency it could also be worked with one or two effects; however, owing to the fact that the plant required so much less cleaning than was anticipated, the spare effect has been used as a preliminary one and quadruple effect has been worked. To explain the operation fig. 1 shows the lay-out of a distiller arranged for double effect, each effect made up with evaporator, separator and heater; the distiller shown is one supplied by the Kestner Company to a power station at Cawn-

* Electrical Review, Jan. 8th, 1926, p. 59 *et seqq.*

pore. The feed water comes into the separator under control from a valve regulated by a float; it flows over a serrated tray, as shown. When the water in the separator falls the valve opens. The water flows down into the evaporator termed the "Calandria," and is heated inside the tubes by the low-pressure or live steam which flows into the surrounding chamber.

In evaporating, the vapour rising carries with it a film of water upwards; this flows into the separator, and after being freed from entrained water it flows into the jacket of the second calandria, part flowing through a branch to a small heater. The precipitation of solids in the feed water is assisted by the water meeting the upward current of vapour from the calandria, and further precipitation takes place in the body of the separator itself; the solids tend to settle down and are removed from time to time with the aid of the sludge boxes below. Thus the bulk of the deposit takes place in the first effect.

The steam, in this case bled from a steam turbine, which heats up the first calandria, is condensed, and flows as water into the jacket of the second calandria through a valve. Owing to the lower pressure in this, a good deal flashes off temporarily into vapour; when condensed it passes through the jacket of No. 1 heater, having been joined by the water condensed in the second calandria, and thence to the feed tank.

Fig. 3 is a diagram of a double effect distiller, showing what sort of results can be obtained; the vapour from the second separator passes through a heater and then flows into the main condenser, the resulting water being returned to the hot well with the turbine condensed steam that was not by-passed. As can be seen, 2,885 lb. of steam at 157 deg. F., 4.4 lb. per sq. in. absolute, passes into the apparatus through the jacket of the first effect calandria; and 5,640 lb. of raw water at 60 deg. F. is pumped through the feed heaters into the two

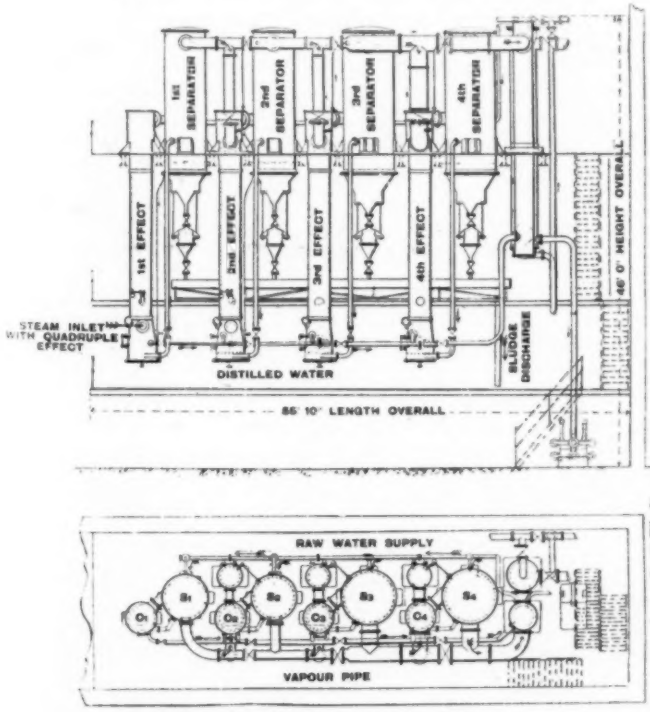


Fig. 2.—Distilling Plant at Comines, France.

separators, part into each. Part of the steam (5,831 lb.) is condensed and passes out as distilled water at 130 deg. F.; the remainder (2,554 lb.) passes as vapour into the condenser. The impurities in the incoming raw water are drawn off through the sludge boxes.

Fig. 2 shows a diagram of the plant at Comines. The raw water drawn from the River Lys is pumped into the fourth heater, and its temperature is there raised to approximately that of the boiling point of the fourth effect, and by means of float valve control a quantity of water corresponding to the evaporation in this effect is fed into the separator. Part of the remainder, under similar control, passes to the third heater, where a temperature higher than that in the second prevails, and then the process is repeated.

The three heaters are heated by means of vapour from the three separators. The water entering the separators is heated up by the vapour from the calandrias and flows down into the latter and circulates until it is evaporated by means of the climbing film action.

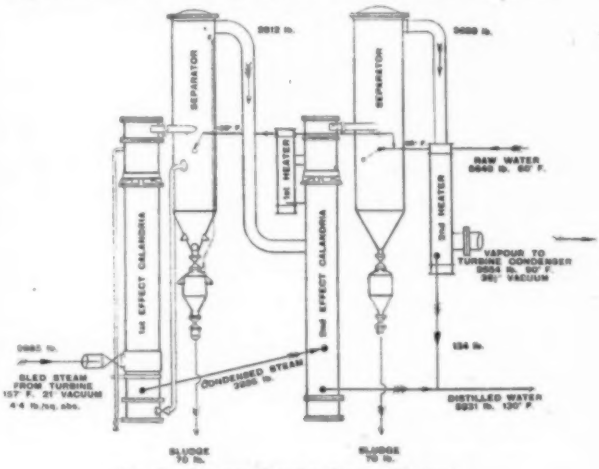
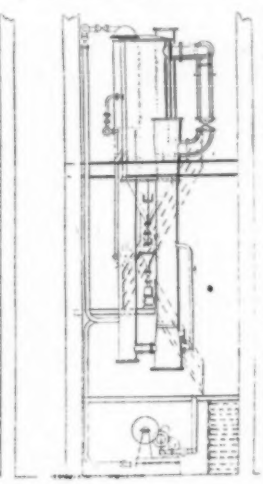


Fig. 3.—Diagram Showing Results Obtained.

The vapour which is not condensed from the final effect is passed into a condenser which is cooled by the main feed water; the heat therefore is not lost. There is a further small condenser which cools any incondensable gas before it passes to the vacuum pump. The operating steam is at about 29 lb. pressure absolute.



Naturally, when a multiple effect is used and the initial pressure is only about 15 lb. above atmosphere, there must be a fall of temperature and pressure with each effect, and the smaller the difference in temperature between the vapour on the one side and the water to be heated on the other, the larger the surface of the tubes must be to deal with a given quantity of water to be evaporated. It is claimed, however, that with the Kestner climbing film evaporator the film is so thin and the velocity is so high that the surface required, even with multiple effect, is lower than that which would otherwise be necessary.

To operate the plant there are three pumps on one shaft driven by a motor: an air pump to ensure the vacuum which enables evaporation in the lower effects to take place at a pressure below that of the atmosphere; a distilled-water extraction pump; and a feed pump which pumps the raw water into the different evaporators. At starting, these pumps combined take about 40 h.p., but in normal working 27 to 30 h.p. only is required. The sludge which accumulates in the bottom of each separator is emptied from time to time by means of valves into sludge boxes, as may be seen from the diagram, and when the top valve is closed again the sludge can be discharged into a trough running below the four separators. As can be seen from the cycle of operations, apart from radiation losses, there is practically no heat loss at all. At times when there is insufficient steam from the feed pump turbine exhausts, live steam can be used, either alone or to assist the existing flow.

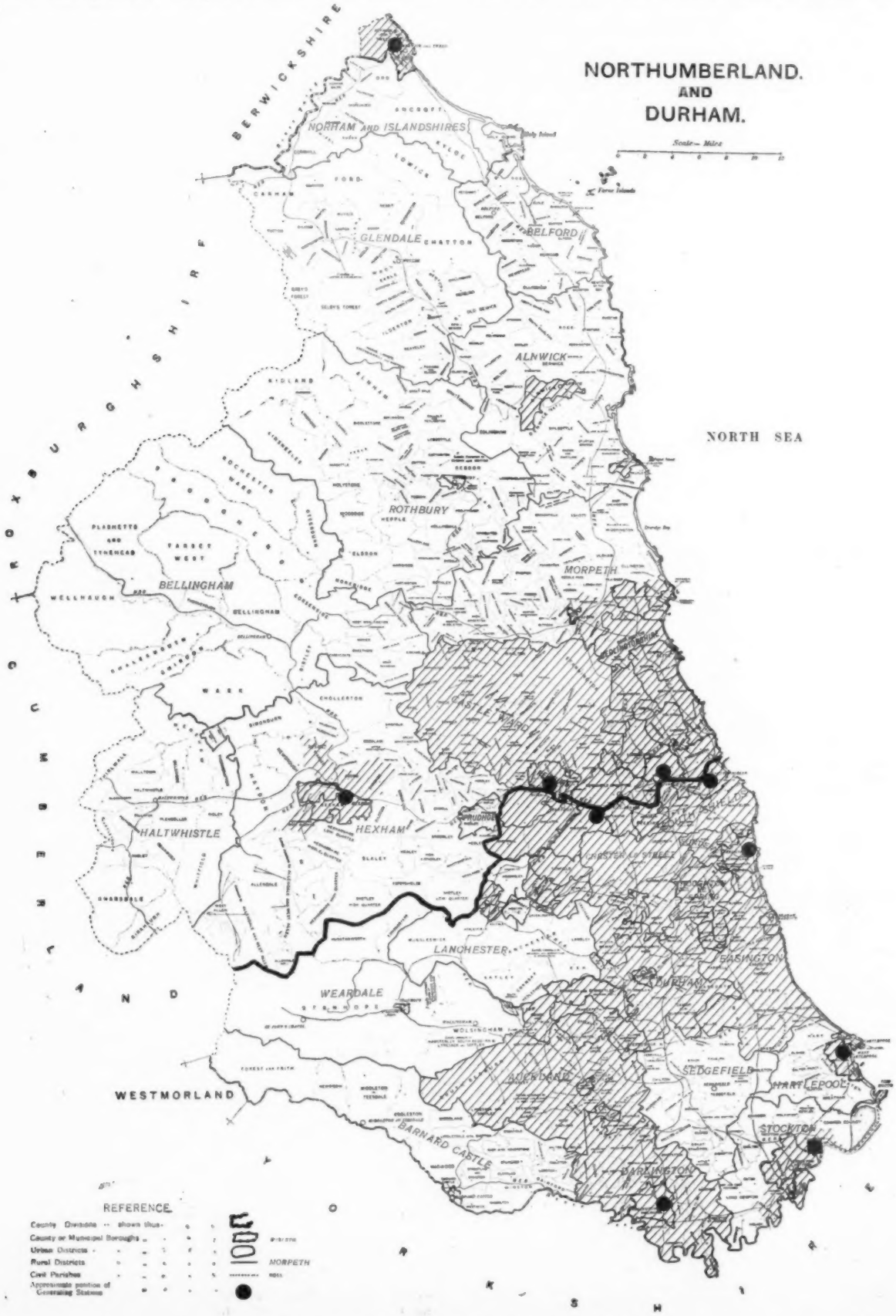
Sight holes are arranged in separators and sludge boxes so that the operation can be watched. In normal operation one unskilled man controls the apparatus.

Thanks must be given to the Kestner Evaporator and Engineering Co., London, for assistance in the preparation of this article.

Electricity Supply in Great Britain.—XIII.

Northumberland and Durham.

Statutory powers for general supplies of electricity have been granted in respect of the hatched areas on the accompanying map, with the exception of Darlington Rural District and Seaham Harbour Urban Dis-



Electricity Supply in the Counties of Northumberland and Durham.

trict, for which areas applications have only recently been lodged by Darlington Corporation and Seaham Harbour Urban District Council respectively.

The areas* of the Newcastle-upon-Tyne Electric Supply Company and its Associated Companies have not been shown hatched, except where statutory powers for general supplies are held or have been applied for, as mentioned above. This group of companies holds various statutory powers under its Acts for the supply of energy, and also for interconnection, &c., with private companies, one of the most important of these being the Tees Power Station Co., Ltd. The generating station (North Tees) of this non-statutory undertaking is situated at Billingham, and is indicated on the map by a square dot.

Although the development of the electricity supply industry in the North-East Coast Area (Area No. 16) has been tremendous, it would seem from the following figures (extracted from the annual publication of the Electricity Commissioners†) that railway electrification in the London Area (Area No. 7) has enabled the latter to maintain the rate of increase in the number of units generated per annum, whilst the former has slackened pace.

Year ending March 31st.	kWh generated. Area No. 16.	Area No. 7.
1922 ...	692,658,577	1,382,462,122
1923 ...	849,694,538	1,561,814,992
1924 ...	985,911,020	1,768,070,741
1925 ...	1,041,659,090	1,949,825,578

The following is a list of the existing authorised undertakers:—

Local Authorities.

Amble Urban District Council.
Annfield Plain Urban District Council.
Crook Urban District Council.
Darlington Corporation.
Newcastle-upon-Tyne Corporation.
South Shields Corporation.
Stanley Urban District Council.
Stockton-on-Tees Corporation.
Sunderland Corporation.
Tanfield Urban District Council.
Tynemouth Corporation.
West Hartlepool Corporation.

Companies.

Cleveland and Durham County Electric Power Co.
County of Durham Electric Power Supply Co.
County of Durham Electrical Power Distribution Co., Ltd.
Hexham and District Electric Supply Co., Ltd.
Houghton-le-Spring and District Electric Lighting Co., Ltd.
Newcastle and District Electric Lighting Co., Ltd.
Newcastle-upon-Tyne Electric Supply Co., Ltd.
Northern Counties Electricity Supply Co., Ltd.
Urban Electric Supply Co., Ltd.

The 1921 Census gives the following particulars for the Administrative Counties of Northumberland and Durham and their associated County Boroughs:—

	Acres.	Persons.	Resident families.	Buildings not containing dwellings.
Northumberland	1,291,515	746,096	160,252	12,563
Durham... ...	649,244	1,479,033	313,791	16,109
Total	1,940,759	2,225,129	474,043	28,672

The map§ is reproduced by permission of the Controller of H.M. Stationery Office. The original was prepared by the Ordnance Survey Department for the 1917 Boundary Commission. The following alterations of areas, &c., have been made since 1917:—

(1) The Parishes of Bebside, Cowpen, Horton and Newsham and South Blyth have been united to form the new Parish of Blyth.

(2) The boundary line between the Seaton Delaval Urban District and Parish and the Whitley and Monkseaton Urban District and Parish has been altered.

(3) Parts of the Parishes of Healeyfield and Knitsley have been added to the Urban District and Parish of Consett, and part of the Parish of Knitsley has been transferred to the Parish of Healeyfield.

(4) Part of the Parish of North Seaton has been added to the Urban District and Parish of Newbiggin-by-the-Sea.

(5) The Parish of Seaton Carew has been merged into the Parish of West Hartlepool, which is now co-extensive with the County Borough.

(6) Part of the Parish of Hawthorn has been added to the Parish of Haswell.

(7) Part of the Parish of Pelton has been added to the Urban District and Parish of Chester-le-Street.

(8) The County Borough and Parish of South Shields have been extended so as to include parts of the Parishes of Harton, Whitburn and Boldon. The remainder of the Parish of Harton was added to the Parish of Whitburn.

(9) The Urban District of Washington has been created, comprised of the Parishes of Barmston, Usworth and Washington.

(10) Blyth Urban District has been created a Municipal Borough.

(11) Billingham Parish has been created an Urban District.

* See also No. XII of this series, ELEC. REV., March 5th, 1926, p. 365.

† "Generation of Electricity in Great Britain." H.M. Stationery Office, price 1s. 6d.

§ 1917 Boundary Commission Maps (Scale: four miles to one inch) are obtainable, price 6d. each, from Messrs. Edward Stanford, Ltd., Long Acre, London, W.C.2.

The Economical Loading of Power Plant.

The Use of the Willans Line.

By J. S. PILLANS, A.M.I.Mech.E.

SHIFT and other engineers who are in charge of steam-driven generating machinery, of which two or more sets are run in parallel, are frequently of the opinion that a saving of steam will invariably follow the giving of as large a proportion of the load as possible to the set which originally showed the lowest steam consumption per kW on test.

This belief, more especially when carried into practice, is undoubtedly praiseworthy, as in the majority of cases it will have the desired effect. At the same time, however, it is interesting to note that for reasons which will be entered into more fully, it does not necessarily follow that the bearing of the major part of the load by the most efficient of the paralleled sets will result in any saving whatever.

The point may be summarised as follows:—Assuming two identical turbo-driven sets, paralleled to the main bars and sharing the load; assuming also that steam and other operating conditions are alike in all respects, and further that their original consumption characteristics were similar; but that their sole difference consists of a pass-out gear fitted to Set 1, by means of which a constant quantity* of steam is drawn for process work, the Willans lines for the two sets will then lie parallel if plotted to a common base, as in fig. 1 (p. 452), though separated by a distance corresponding to the amount of pass-out steam.

It will be seen that in this and similar cases where the Willans lines lies parallel, the combined steam consumption per kW for the two sets is independent of the load distribution.

By way of example, the full load F C (fig. 1) may be taken as carried by Set No. 1, Set No. 2 running light. Then the combined steam consumption in lb. per hour will be given by AC plus EF.

*Conditions which, on the ordinary run of pass-out turbines will not be attainable. The assumption is, however, justifiable in order to illustrate the contention.

If now the load is wholly transferred to Set 2, with Set 1 running light, we have the combined steam consumption equal to BC plus DF, and hence for all variations of the load distribution AC plus EF equals BC plus DF. This shows that for paralleled power plant, the Willans lines of which under actual operating conditions are separated by a constant difference, the load distribution is immaterial.

In the case of, say, two paralleled engine-driven sets, of which one is less efficient than the other by reason of badly-fitting piston rings, at no load, the difference in steam consumption will be relatively small, increasing rapidly with rising mean effective pressure, a state of affairs shown by the Willans lines in fig. 2; as before, it may be assumed that the leakage mentioned constitutes the sole difference between the sets, although the issue is dependent only on the Willans lines and not upon the determining factors of these, such as capacity of plant, &c.

Applying the same reasoning as in the former example, it will be seen that economy of operation will vary with the proportion of load carried by Set 2, and that this condition will be shown by divergence or convergence of the Willans lines.

Naturally, under the normal conditions of station operation, the sets will be subject to widely different conditions, such as initial efficiency of design, state of repair, normal vacuum, distance from boilers, generating efficiency, &c., all of which, however, may conveniently be combined and correlated by drawing the Willans lines to a common base; whether the sets be large, small, turbo or engine driven, old or new, &c. Such a case may be depicted in fig. 3 for a medium-sized station equipped with turbines, but having reciprocating stand-bys. If a chart of this kind is drawn up by individual stations, it constitutes a valuable guide for the shift engineer who, by visually comparing the lines of the sets he is running, is enabled to form an accurate judgment of the advantage to be gained by loading up to the maximum desirable the set or sets which show a Willans line having the smallest angle of inclination to the horizontal. As heretofore, the question which set or sets he shall run will depend on local conditions; the chart makes no attempt to govern this, but only to enable the running sets to be used to the best advantage.

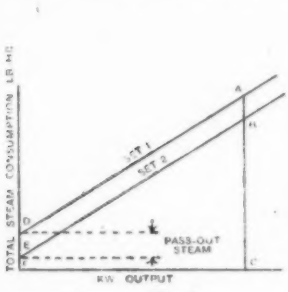


Fig. 1.

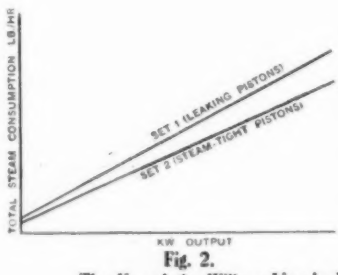


Fig. 2.

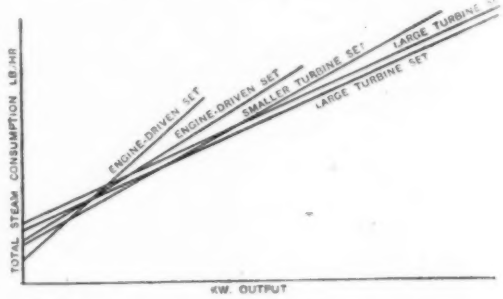


Fig. 3.

The Use of the Willans Line in Parallel Operation.

In certain cases such as will occur when impulse turbines are fitted with governors of the overload nozzle disclosing type, the Willans lines will not run straight. Under these conditions, obviously, it will be necessary to judge the slope of the line between the required limits of the load.

It is suggested that a chart of this description showing the Willans lines of all sets in the station, under normal conditions of working, could with advantage be displayed in every control room and switchboard gallery, and should prove of material value in the economical working of the station.

The Birmingham Electric Club.

Annual Dinner.

THE fifteenth annual dinner of the Birmingham Electric Club was held at the Grand Hotel, Birmingham, on March 12th, and many representatives of the various electrical organisations in the Midlands were present. The company numbered about 250, and Mr. A. E. Cunningworth (President) occupied the chair.

The dinner coincided with the publication of the Government Electricity Bill, and severe criticism of it was voiced by Mr. P. J. Hannon, M.P., in proposing the toast of the "Electrical Industries and Electricity Supply." A serious side of the Bill, he said, and one to which all who were familiar with the direction of electricity schemes would have to give considerable thought, was the fact that out of the 40 clauses of the Bill, there were no fewer than 39 instances in which the work of the National Central Board—composed of the very best minds of the country—became subject to the approval of the Electricity Commission. This, in his opinion, almost amounted to a tragic blunder on the part of the Government, although the present Electricity Commission was efficient, impartial, and competent to deal with the great cause placed in its trust. It would seem to him that the Electricity Commission should prepare the schemes and leave it to the National Board to adopt them, limit them, or cut them down. Real success in the distribution of electricity for the benefit of the nation, the advancement of industry, and the welfare of the people, could never be obtained with the interference of bureaucratic authority.

With regard to the suggested expenditure of 33½ million pounds on the schemes, the test of the efficacy of the measure was—how much it would cheapen the supply of electricity for power and light to the consumer, and to what extent it would enable districts hitherto deprived of power, through geographical or other reasons, to enjoy sources of electrical power. He had been unable to discover in the Bill any suggestion that Birmingham or similar centres were going to obtain cheaper and more abundant supplies of electricity.

Mr. R. A. CHATTOCK, M.I.E.E. (President of the I.E.E.), responding, said that it was well known that the electrical industry in this country was in a flourishing condition, and he thought they should all be thankful for it. They all hoped that the black cloud that was at present overshadowing the engineering industry of the country would break and that they would soon see a settlement of the trouble which had been threatened. With regard to the Electricity Bill, he quite agreed with Mr. Hannon in his indictment of it so far as the question of control was concerned. He did not think any body of men should be called upon to take the responsibility of determining those enormous issues on which the progress of this country so largely depended, and they all hoped that further consideration and discussion of the clauses of the Bill would direct the Government along the proper lines and that they would eventually get something that would benefit the country and the industry. From conversations that he had had with representatives of electricity supply undertakings he felt that they were looking for something much better than had been described to them. Regarding the statement that a sum of 33½ millions was to be placed at the disposal of the Board, Mr. Chattock thought that it was quite impossible to say off-hand what finance would be required. Apparently certain stations were to be selected to carry on the supply. Others would undoubtedly have to be established, and it was not clear how these were to be financed and how they were to be worked into the scheme generally. There was very little wrong with many of the existing undertakings as regarded their generating capabilities. They could not want anything better than the station at Manchester. He could not but believe that a

certain eminent electrical engineer had been misreported when he stated the other day that the new Government scheme would have the effect of making it possible to supply electricity for lighting, power, heating and railways at a cost of a farthing per kWh. It was a great pity to lead the people to expect a result of that kind, because he thought it was obvious that the cost, especially for lighting, must exceed that figure very greatly. He thought that what was referred to was the cost of generation. He was glad that it was proposed that a representative of the railways should sit on the Board; he felt that railway electrification was going to be a material factor in the progress of electricity in this country. With regard to the matter of frequency, that had been one of their nightmares in Birmingham. If it was decided to couple up a big district like Birmingham with another district it was possible to do so by means of frequency-changers. New plant should be designed to take into consideration the low-temperature carbonisation of coal. There had been a lot of discussion on the subject of late and methods were being developed which, he thought, would solve the problem. So far they had not had anything which had been commercially possible, but experiments were going on in America on a large scale which they were watching very closely and which bade fair to show good results. He hoped that any scheme developed by that Board would take that into consideration.

The toast of "The King" was proposed by Mr. F. W. Martin, the secretary of the club; the "City of Birmingham," by Prof. W. Cramp, D.Sc., M.I.E.E. (Birmingham), and responded to by Councillor H. K. Beale (Chairman, Birmingham Electricity Supply Committee); the "Birmingham Electric Club" by Mr. H. Berry, and replied to by the President (Mr. A. E. Cunningworth); and "The Visitors," by Mr. F. R. Unwin, A.M.I.E.E., and responded to by Mr. A. D. Phillips, M.I.E.E. (Derbyshire and Notts. Elec. Power Co.).

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

"Electrical Freedom."

Reiterated fallacies are treated seriously at times, and Mr. Robinson's article has not been challenged generally, although when stripped of all personal references, among other myths the spectre of Nationalisation is apparent, for he appears to demand complete control of every industry employing electricity, and suggests that the centralisation of control incurs no additional cost, and gives complete efficiency with economy.

Many newspapers have taken this view, and the following is a fair sample of what is written:—

"Mr. Baldwin's electricity scheme has had a very good Press, all sections have welcomed it. It is hoped that in many districts current will be obtained at less than ½d. per unit."

In addition to the cost of generating current at the station, however, there are other services, and total costs should surely be counted! But is the cost of connecting cables, the new department created, the cost of meter reading, and collection of accounts, &c., included in this figure?

Relieved of financial stringency and given sufficient scope, the manufacturer using steam in process work does not convert from steam to electric drive very readily; on the contrary and under certain circumstances, he cannot afford to buy energy from an outside source.

Mr. Robinson writes: "Surely if the supply of electricity is cheap and abundant, the installations must be cheap and abundant also." What do we find cheap in large installations?

1. A costly cable.
2. A specially built transformer house.
3. Transformer.
4. Main switchboard.
5. Motors, &c.
6. New shafting and drives.
7. New laws and regulations.

These are a few of the difficulties some contractors have to compete with, at least up in this part of the Kingdom, where I am happy to say the supply engineer generally heartily co-operates with the contractor, who is acknowledged to be the unpaid traveller, and commands respect accordingly.

Private enterprise is not finished with, and the contractors may yet be busy fitting up self-contained plants for customers who are experienced in buying "cheap" electricity from outside sources.

A more enlightened policy might, with advantage, take the place of the suggested misdirected one.

L. E. Wilson.

Manchester, *March 8th*, 1926.

If you are not overburdened with correspondence on this subject, may I mention my recent experience with a supply undertaking which obtained an important wiring contract in competition with a reliable independent member of the N.R.E.I.C. The company's tender was slightly higher, but was accepted by the clients, against advice, on the ground that they were good customers of their own. During procedure it came to light that the company were neither complying with the specification on which they tendered nor even complying with their own regulations. Naturally the whole of the wiring had to be pulled out, and this in the case of a company supplying a large area of importance and certainly one with fully competent engineers at the head, who, however, probably think that installation work is as well left to any of the staff who have proved themselves incompetent on the switchboard.

May one reiterate that Mr. Robinson shows so much bias in his statements that most thinking men would be suspicious of his deep reasoning and unlikely to accept his didactic statements without careful examination of the facts from all points of view.

Not a Contractor.

London, *March 12th*, 1926.

In this week's issue Mr. Robinson has received some well-earned rebuffs, and it is to be noted that this humorous (?) engineer now states that this is not a question of municipal trading. The latter statement would point to the fact that the article by Mr. Robinson is inconsistent, as the whole article was crammed with boost for municipal trading. I desire to associate myself with the concluding remark of "Registered Contractor" where india-rubber is mentioned.

Why should supply authorities be allowed to poach in the electrical contracting field when their time should be fully occupied on the supply side of the industry? This growing menace to the electrical contracting industry is but a form of Municipal Socialism, and one might as well say that municipalities should set up business in all trades and thus effectively stop all private enterprise. Who has a better opportunity of making a high-class show of electrical appliances than municipal authorities with the ratepayers' purse? They can generally pick out the best site in a city for a highly extravagant showroom and are in the happy position of being able to use up the kilowatts for demonstration purposes without having to worry about a heavy current bill. Is it to be wondered at, then, that they can sell a few more vacuum cleaners and hair driers than the (according to some people) inefficient contractors? Your correspondents in the current issue have a good grasp of the situation, and it is hoped that something effective will be done in this session of Parliament to put a stop to this municipal poaching. It certainly seems to be the desire of certain individuals to get us "washed out" but—we are waterproof.

Contractor.

Glasgow, *March 13th*, 1926.

The Metering of Electricity.

In your issue of the 12th instant you published an article by Mr. S. H. Penning on the above subject.

In this he explains that a few months ago he devised means whereby both the fixed charge and the low running charge per unit, in a two-part tariff, can be measured by the same meter, and he goes on to describe the means whereby this result is attained.

We think we ought to point out that we have been engaged on this problem for a good many years, and as long ago as March 8th, 1922, we took out our first patent, No. 198,772. The system has also been patented in the United States, Germany, and other countries.

Claim 1 of the patent in question reads as follows:—

"A Motor Electricity Meter in which the rotary element rotates on no load provided with a direct connection between the rotary element and the counting train so that the meter registers continuously at a certain pre-determined rate when no load is being taken in the consumer's circuit."

The Electrical Apparatus Co., Ltd.

R. Amberton, *Director.*

London, *March 12th*, 1926.

Country House Fires.

Your recent article on the above subject has particularly interested me, for only a few weeks ago I was asked to test a private installation with a view to its being turned over to a public supply. The installation, I was informed, was put in only a few years ago and was supposed to have been carried out on the lead-covered system.

On testing, several circuits were found very low, and on proceeding to investigate the cause, I found in one of the bedrooms, near the switch, a single core lead-covered cable, together with a twin flexible, tucked away at the side of the door frame; these passed into the picture moulding and were run along two sides of the room, eventually terminating in a bracket over the bed. On making further investigation, lead-covered cables were observed on the surface of one of the corridor walls, and to all appearances looked as if they passed through the wall into a cloak room, but on making an examination in this room no such wires appeared. In order to locate the direction of these wires, some of the plaster was cut away, and much to one's astonishment, the wires were found bunched and tucked away in a previously made hole which had been filled in with plaster of Paris. Still further investigation revealed some of the wires run along the surface under the picture mouldings and protected by wood casing. At one point where they radiated from a distribution board on the first floor landing, a 12-in. by 12-in. wood pattress was fixed, on which was mounted the distribution board. On removing the screws holding the pattress, a hole was found chiselled out in the plas-

ter and brickwork and the *joint*, as sent herewith, found. In another part of the house a nail driven through the capping and lead-covered cable was located.

As already stated, there were 60 points in the house; not one single junction box was found, all joints having been made in the manner of the sample sent you, and in each case buried.

Needless to say, an adverse report had to be given and the house is now being entirely re-wired.

I thoroughly endorse the remarks regarding the inspection and testing of installations—new and old—by the Insurance Companies, and add that they should be Engineering Insurance Companies which employ a competent electrical staff.

A. Douglas.

Stoke-on-Trent, *March 10th*, 1926.

[The tangle of flexibles, lead-covered wires, bonding wires, and tape which we have received from Mr. Douglas, beats anything that we have previously seen in the shape of a "joint"; we could not have believed that any sane person could have perpetrated such a job. It has one redeeming feature: it shows the inherent safety of electric lighting, for it has been in use for some years, presumably at 50 or 60 volts, without burning out. This must be an exceptionally bad case, but it emphasises the necessity of examining old installations.—Eds. Elec. Rev.]

I have followed with interest the correspondence by Mr. F. J. Moffett in connection with the above subject, and think his suggestion of inspection by the Fire Offices worthy of the fullest consideration.

A considerable number of the leading Insurance Companies have engineering departments which undertake the insurance of motors, generators, transformers, &c., against breakdown, which service includes a quarterly inspection and test.

I see no reason why this service should not be extended to electrical installations generally, the wiring being insured against "Faults," and the service to include a quarterly inspection and test of the whole of the installation. In the case of new work the service would provide for a number of inspections during the course of erection. If this scheme were put into force the person insured would be safe in the knowledge that his electrical work had been carried out in a thorough and workmanlike manner and in accordance with the I.E.E. wiring rules, and it would at the same time reduce the fire risk from the "fusing of electric wires" to a minimum.

C. A. Besley.

Cardiff, *March 12th*, 1926.

Ready-made Showcards.

If manufacturers and suppliers were to provide artistically designed show-cards (of a size suitable for each article) stating clearly the price, use, consumption in watts or units, catalogue number, &c., of the different pieces of apparatus which they supply (for instance: Electric iron, weight —— lb., consumption —— watts, price £——, Cat. No. ——, &c.) we consider that it would materially assist in increasing business.

We suggest that these should be supplied, or sold at a nominal price, to contractors, who would display them with the apparatus in their windows, &c. The cost of making and printing these cards would be low, if a number were produced, but the expense and trouble to a contractor of getting out individual cards is considerable.

J. & T. Robinson.

Croydon, *March 9th*, 1926.

A Bootle Wiring Contract.

Our attention has been drawn to a paragraph in the issue of your journal of the 13th instant, referring to a contract for the electrical installation at the Cleaver Sanatorium, Heswall. The paragraph states that by a majority of the West Derby Board of Guardians (28 votes to 22), it was resolved to apply to the Ministry of Health for a judicial inquiry to be made into the contract.

As the contractors concerned, you will readily understand that our mouths are sealed, and that it would be highly improper for us to refer to the matter in any way until after the proposed inquiry has been held.

Under these circumstances you will, we are sure, be disposed to suspend any judgment on the matter for the present.

The Knowsley Electrical Co., Ltd.
D. McKinnell, *Secretary.*

Liverpool, *March 15th*, 1925.

Electricity Generation in Switzerland.—Our correspondent in Switzerland states that the net production of energy in Swiss power stations at the end of 1925 was 520,000 h.p., a figure which is expected to be increased to 1,850,000 h.p. when all the hydro-electric power houses are fully equipped. Forty-six per cent. of the energy is produced by private enterprise, 17 per cent. by cantonal stations, and 11 per cent. by the C.F.F. stations. The large generating stations at Rempen, Siebnen, Klosters, Chancy-Pougny, Massagno, Näfels, and Turtmann were in full working order during the past year.

Reviews.

Electrical Estimating for Industrial Lighting Installations. By J. C. Connan, B.Sc., A.M.I.E.E. Pp. 214; 33 tables and five appendices. London: E. & F. N. Spon, Ltd. Price 12s. 6d. net.

Mr. Connan has written a book upon a subject which has been neglected in the past, but one which is of vital importance to the prosperity of electrical contracting businesses. From time to time it has been pointed out in the Electrical Review that quotations for lighting installations and similar contracts have shown such great variations in any one case as to lead to the almost inevitable conclusion that most of these quotations were based upon anything but sound estimates. The plague of price cutting which causes so much embarrassment to well organised firms and bankruptcy to their "rule-of-thumb" and slipshod competitors, can only be eradicated if the trade is willing to be educated into better ways, both of organisation in general and of costing and estimating in particular. It is therefore with considerable interest and hope that Mr. Connan's book will be received.

The title of the book is scarcely comprehensive of its contents, for not only does the author indicate very fully what are presumed to be his own methods of estimating, but he discusses at length the theory and practice of illumination and electrical wiring for lighting installations. Thus we find that out of 200 pages of text, 114 are devoted to the following subjects:—Definitions and laws, the theory of illumination, the factors to be considered in choosing the nature and the quantities of the illuminant, systems of wiring and accessories, and the size of conductors. Nothing but praise can be given for the lucid and able description of these subjects, and for the admirable blending of theory and practice contained in the first part of the book, except perhaps that the author sets out in too confident a manner to enlist the support and interest of a certain section of the industry. In the preface it is stated that one of the objects of the book is to enable the contractor who is deficient on the theoretical side to obtain this knowledge without undue waste of time. Another object is to draw the attention of architects, engineers, and others responsible for, or interested in, installations to the subjects treated in order to eradicate the too frequent absence of specifications, or the issue of faulty or incomplete specifications. Both these are laudable objects, and it is to be hoped they will, in the interest of all concerned, be achieved. However, in considering the object first stated in conjunction with the first page of the text, one can imagine the "practical" contractor being a little overwhelmed by such statements as these: "The steradian is given by the formula: $\omega = 2\pi(1-\cos\alpha)$ and luminous intensity by $I = dF/d\omega$." There is wisdom in beginning a book with definitions, but if they are stated thus, one is fearful of some of those for whom the book is intended not getting beyond the first page. As a handbook, it ought to be found on the desk of every large contractor, but in the case of the smaller contractor we suggest that he should skip most of the earlier part of the book until he has thoroughly digested the latter part.

In the latter part is to be found an immense amount of data compiled for the use of contractors and, if used with caution, there is no doubt that this information would be of the greatest assistance.

Installation and running costs are discussed, and many tables are included, giving the "equivalent" hours required for a large variety of operations. The installation costs are divided into material, labour, freight and packing, overhead and extras; the very necessary item of profit is also dealt with. The running costs are divided into fixed charges, maintenance charges, and the cost of energy, and each division is considered separately. Checking of quantities, and prices, preparation of the estimate and quotation and an example of a completed estimate and tender then follow.

The "self-cost" prices in loose leaf form, advocated by Mr. Connan, are highly commended, and we repeat the author's words concerning them: "*Every* contractor should prepare for himself a loose leaf book containing the 'self-cost' to him of *all* material he commonly uses *and* should keep the book up to date as the prices change."

There are, however, several important matters in which we find ourselves at variance with the author.

The method of treating labour costs presents what would be in the hands of anyone less capable than the author, a somewhat dangerous means of arriving at estimates of labour costs. This section should be read very carefully and thoroughly understood before it is acted upon. The assessment of "equivalent" hours would be the most convenient method of dealing with labour costs if they could, in their original form, be used upon all occasions; but the author himself gives twelve reasons why this cannot be so. One has to have standard conditions only before their use is justified, and if the actual conditions do not coincide with the basic standard, one is asked to rely upon percentage additions to the standard equivalent hours for each contingency. We distrust these percentages, for in them all the original accuracy of the standards is apt to be lost. Rather than attempt to tamper with the sound standards by the use of elusive and hypothetical percentages, we suggest that the actual hours of work that have been carried out, under conditions that do not approximate to the standard conditions, should be used wherever possible as the basis of

estimates. Estimates are bound to contain some judicious guesswork, when they relate to work that has not previously been attempted, but let the greatest possible proportion of estimates be the reflection of actual practice. It is much safer to work things out for the actual conditions under review than to juggle with figures based upon entirely different conditions and make them do.

The list of overhead expenses and the notes relating to them are comprehensive and of great utility, but here again we cannot see eye to eye with the author, so far as his method of distribution is concerned. In every branch of every trade overhead expenses are the most troublesome part of costs, and therefore of estimates, and we cannot find sufficient theoretical argument in favour of the adoption of any one of the methods suggested. We ourselves fancy quite a different means of distribution.

The author commits an arithmetical error when, on page 160, he endeavours to subtract percentages of two different quantities from a third in order to arrive at the percentage saving in yet a fourth. It just cannot be done so easily. Contractors should certainly be able to demonstrate with actual figures the advantages to be gained by the adoption of their recommendations, but we would plead for accuracy in the figures they use, and thus for their adherence to the advertiser's slogan: "Truth in advertising."

We are in full agreement with the author's dictum on page 170, that thorough practical experience and technical training are necessary qualifications of the estimator. In the same chapter good use is made of a sound system of checking, which will repay careful study.

The section dealing with the completed estimate and the tender might be apt to frighten one who has never taken great care over his estimates. This is, however, the culminating point in the book, and it is sincerely to be hoped that many contractors will actually be frightened by it, but nevertheless take it seriously to heart and endeavour to place their industry upon a higher plane, by making their estimates representative of really sound practice, so that tenders may in future not be discredited owing to their wide disparities.

We must congratulate Mr. Connan upon the production of a book dealing so fully with this very important subject, and, though we cannot agree with some of his basic methods, we think that every contractor who reads the book will find much that will aid him in attempting to estimate and quote more reliable prices.

The Mathematical Theory of Electricity and Magnetism. By J. H. JEANS, D.Sc., LL.D., F.R.S. Fifth Edition. Pp. viii + 652; figs. 140. London: Cambridge University Press. Price, 21s. net.

The work is so well known, and its reputation so widely, indeed universally, acknowledged, that it will not be necessary in this review of its fifth edition to do more than point out to our readers the particulars in which it differs from preceding editions, and describe the new features which have been added so that they may be in a position to judge in what respects the new book is different from that with which they are already familiar. The last edition, though reprinted in 1923, remained unaltered from the form in which it first appeared in 1920, and the changes and additions the author now deems expedient arise in the main from the great advances which have been made in the elaboration and application of the theory of Quanta and the Relativity theory, during the last six years. Thus, in the introductory division of the subject into three branches: Electrostatics, Magnetostatics, and Electrodynamics, it was stated in the fourth edition that Maxwell's hypothesis (*viz.*, that electrostatic and magnetostatic phenomena might be stresses and motion of a medium, consistently with the laws of dynamics) would be dealt with in the body of the book, "an alternative possibility being considered in the last chapter." In this edition the statement becomes: "As will be seen later, recent developments call for at least a drastic modification, and more probably for the complete abandonment of the whole hypothesis." In the first chapter, on "Physical Principles," the section on the "Modern View of Electricity" has been considerably amplified and amended, to bring it in touch with recent developments of theory, but the "summary" has not been altered. There is no further change of importance until Chapter VIII, in which some alterations in the treatment of Ellipsoidal Harmonics are introduced; slight alterations in section 601 and section 620 of Chapter XVIII, again refer to the growth of evidence that a "new system of dynamics and a new electron theory are needed."

Sections 635 and 636, Chapter XIX, on the Zeeman Effect, have been re-written; and section 647 of the same chapter, on the field set up by moving electrons, has been much enlarged. The following three sections dealing with the motion of electrons, and with the radiation of energy, have also been amended; and to section 651 is appended a paragraph, pointing out that the development of the new dynamics makes it clear that the theories of Maxwell and Stokes do not suffice to explain X-radiation.

The really important changes in the new edition consist of additions, at the end of the book, designed to supply in some degree the theoretic developments, the need for which has been indicated from point to point in the body of the work. The fourth edition ended with section 701 of Chapter XX. To this chapter are now added five more sections, treating of Generalised Relativity, Weyl's Electromagnetic Theory and matters cognate: and the new edition contains also an additional chapter, Chapter XXI, dealing with the Electrical Structure of Matter.

It is in this chapter that readers will naturally be most interested, but it is not here possible to reproduce in a few bright, well-chosen words, the substance of what Dr. Jeans, in his concise and lucid style of writing, takes a whole chapter to accomplish. It might be as well, however, to remind the reader, as the author does from time to time, of the immensities of magnitude and minuteness which are represented by those little figures so easily written at the right-hand top corner of another symbol. Theoretic investigations do not lead to practical results unless they are thoroughly understood, and it needs a very special effort to really understand dimensions of a magnitude our senses are not fitted to perceive. Mere manipulators of symbols are apt to forget that. Our notions of force, also, are derived primarily from our experience of gravitational forces, amid which we live and move and have our being. "The electric force of repulsion outweighs the gravitational force of attraction in the ratio of 4.2×10^{42}," as the author finds occasion to state in section 28.

A kilogram of electrons, crammed together in cubical piling, would occupy a space measuring about the thousandth part of an inch across each way, while two grammes of electrons, that is to say, two bodies occupying but one thousandth part of the first bodies, would, if placed a metre apart, "repel one another with a force equal to the weight of 3×10^{29} tons." Compare the weight of the earth. We leave our readers with the problem of conceiving the forces which would be required to hold the electrons thus crammed together. Such are the forces with which electricians have to do.

Coils and Magnet Wire. By C. R. UNDERHILL. Pp. xi+494; figs. 197. London: McGraw-Hill Publishing Co. Price, 20s. net.

In view of the widespread use of coils in so many and various types of electrical apparatus, it is rather surprising that there have not been more books written on the arts of their design and manufacture. Mr. Underhill is well known as a writer on magnets, and he has had considerable experience in coil construction. In the present volume he has some useful things to say on the subject, but, unfortunately, he has taken the opportunity to say a number of other things which are by no means so valuable and are but distantly connected with his main theme. In this way he has swollen his book inordinately. For instance, in discussing "Temperature and its Effects," he devotes a paragraph to the liquefaction and solidification of hydrogen, while his references to absolute temperature are much too extensive for the purpose in view. The usual methods of manufacturing magnet wires are described and very complete tables of the properties of bare copper wire and of the space factors, &c., of different kinds of insulated wire are given. These tables refer almost entirely to American wire gauge, however, and therefore have little interest for most British readers. As an example of the author's prolixity we may quote a passage from the chapter on "The Basic Principles of Coils." "The length of the insulated conductor is equal to the length of the bare conductor. The length of the conductor is equal to any of the following: (1) The product of the average girth and the number of turns. (2) The ratio of the volume of bare conductor to the cross-section of the bare conductor. (3) The ratio of (*a*) the product of the coil volume and the space factor, to (*b*) the cross-section of the bare conductor," and then, in case we have not understood, three numerical examples are given and the whole section occupies about one page. As another example of the same fault we may quote two pages given up to a string of the names of devices in which coils occur. Surely electrical engineers do not require to buy a list of this sort! Much of the book is on this level and it is difficult to imagine for what type of reader it has been intended.

The forms of coils used for various purposes and methods of winding them are dealt with fairly fully, but a more detailed description and discussion of automatic winding machines would have been welcome. A considerable section of the book is devoted to Insulation, Varnishes, Treatment and Impregnation. Most of the section is of the nature of a symposium to which numerous authorities on these subjects have contributed directly or indirectly. In such a symposium there is necessarily much repetition and the opinions expressed on some points are not all identical. Here we feel we should like to call upon the author's experience in deciding between them, but he fails us. The volume terminates with a useful chapter on testing.

The author has read widely and has spent immense pains on his book; there is a vein of good material running through its pages and if this had been separated from the rest and published at 7s. 6d. it would have been worth the money.

Engineering Apprentices' Competition.—The London Association of Foremen Engineers, in conjunction with the London County Council, has established a scheme for the award of prizes to approved students of mechanical engineering who submit finished pieces of work for competition in accordance with specified conditions. Prizes of £5 and a gold medal, £2 and a silver medal, and £1 and a bronze medal, and a silver shield to the Institution presenting the winner of the first prize, will be awarded.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The Threatened Engineering Lock-out.—Last week the National Committee of the Amalgamated Engineering Union instructed the 900 employés of Messrs. R. Hoe & Co., Ltd., who struck work without the Union's sanction, to return to work, stating that if they failed to do so "disciplinary action" would be taken against them. It was expected that the men would accede to this instruction and thus avert the lock-out which was due to commence this week-end, which would have enabled the questions at issue between Messrs. Hoe and their employés to be dealt with officially by the Union.

In consequence of the alteration in the position, the London District Committee of the Electrical Trade Union decided to defer further action in the matter of holding up electricity supply in the event of a lock-out until to-day (Friday), when a meeting is to be held.

The strikers refused, however, to obey their Union's instructions, and it was expected at the time of our going to press that they would either be expelled from the Union or alter their attitude at the last moment. In any event it was not anticipated that the employers' lock-out notices would be acted upon.

Irish Free State Electrical Imports.—From trading returns issued recently, dealing with the Free State imports and exports for the whole of 1925, it appears that electrical goods to the value of £403,585 were imported, as compared with £396,987 worth in 1924.

British Capital in Poland.—The British Overseas Bank, which is largely interested in the Anglo-Polish Bank (of Warsaw), the Polish sugar industry and electricity undertakings in Poland, has arranged a credit for £250,000 for the construction of electric railways and tramways for the suburb of Warsaw.—*Reuter* (Warsaw).

Electricity in "Weir" Houses.—At its next meeting, Glasgow Corporation Electricity Committee is to consider the request of the local branch of the Electrical Trades Union that the Corporation should refuse to supply electricity to Weir housing schemes. Meanwhile, Mr. Mitchell, the electrical engineer, is to investigate Messrs. Weir's methods of executing electrical work for these houses.

Metal Trades Benevolence.—This week a special appeal has been issued by the Lord Mayor to 30,000 firms connected with the metal trades in Great Britain, calling upon firms and individuals to assist the funds of the Royal Metal Trades Pension and Benevolent Society, which holds its 78th anniversary festival on June 1st next with the Prince of Wales present. It is desired to increase the income by £10,000 per annum so as to advance pensions above the pre-war basis and to help cases which have at present to be refused. Mr. A. K. Steven (McDowall, Steven & Co., 2, Upper Thames Street, London, E.C.4), is chairman of the board of management.

Reunion of the Ex-British Westinghouse Association.—Over 130 ex-British Westinghouse men attended the eighth annual reunion dinner at the Holborn Restaurant, London, on March 5th. Mr. O. H. Baldwin presided. In proposing the toast "The Association," he said that the attendance was the best since the first reunion in 1919. The toast was coupled with the names of Mr. L. S. Richardson, the hon. secretary, and Mr. W. E. Warrilow, assistant hon. secretary, who both acknowledged. The "Silent Toast," also given from the chair, included references to the members of the Association (Messrs. E. R. Myers, Max. Halder, F. Suffield, E. Chambers), who have joined the great majority during the past year. "Absent Friends," submitted by Mr. C. T. Allan, was honoured at 10 p.m. Mr. M. M. Gillespie did full justice to the toast of "The Chairman," and Mr. Baldwin, in reply, was full of reminiscences, anecdotes and narratives. The entertainment, under the direction of Mr. H. S. Aspinall, included items of song, story and legerdemain. An important event of the evening was the ballot for life membership of the Association. The gathering included a number of ex-B.W. men who had specially travelled from South Wales, the Midlands, Lancashire and Scotland. The Association is, we understand, in a flourishing condition and the ninth reunion will be held in London on March 11th, 1927; Mr. L. R. Morshead, who is a member of the original committee, has kindly agreed to occupy the chair on that occasion.

Australian Radio Exhibition.—The N.S.W. Electrical Employers' Federation is organising an exhibition of radio apparatus to be held in Sydney for a week commencing May 3rd.

New Australian Companies.—The Western Electric Co. (Australia), Ltd., was recently registered in Sydney, with a nominal capital of £100.

Town Lighting Ltd., is the name of a company recently registered in Sydney, with a capital of £10,000, to acquire a concession to supply electricity in the municipality of Bombala (N.S.W.).

British Industries Fair.—CORRECTION.—THE IMPERIAL ENGINEERING CO. asks us to state that its wash boiler mentioned in our last issue, in connection with the Birmingham Fair, has a capacity of 10½ gal., not 2½ gal. as stated.

Foreign Samples Exhibitions.—During 1925 the Department of Overseas Trade organised 41 foreign samples exhibitions in London and provinces, mainly with the assistance of local Chambers of Commerce. The number was nine greater than in the preceding year, but the attendance was lower owing to a new policy of restricting invitations to firms known to be directly interested in the goods displayed. A total of 10,247 samples were loaned as well as 16,631 foreign catalogues, among which were publications dealing with electrical goods. The work of the Foreign Catalogue Library continues to increase and the collection now numbers 16,254.

Unemployment.—There was a further reduction (18,660) in the total of registered unemployed persons during the week ended March 1st. The total was also 128,518 less than at March 2nd, 1925.

Hackney Electricity Department: A Protest.—Rather late in the day the Council of the Hackney and Stoke Newington Chamber of Commerce has passed a resolution protesting against the Hackney Electricity Department selling fittings and conducting wiring contracts by direct labour and in competition with traders in the borough. The Council, among other things, expresses the view that the showrooms should be used for the display of goods and not for the sale thereof. The resolution does not say whether those who receive the orders as the result of this display will be prepared to bear their fair share of the cost of the upkeep of the showrooms.

An Engineering Merger.—It is announced that the boards of Mirrlees, Bickerton & Day, Ltd., and the Mirrlees Watson Co., Ltd., have decided to recommend the amalgamation of the two companies between which there exists a close association. The merger will be effected by the sale of the assets of the Mirrlees Watson Co. to the other company for a consideration of 244,000 fully-paid ordinary shares in Mirrlees, Bickerton & Day, Ltd. This and shares already held and £50,000 to be retained will enable the Mirrlees Watson Co. to allot to its shareholders seven new shares for each five held, together with a capital repayment of 5s. per share in the event of liquidation and distribution of assets. Mirrlees, Bickerton & Day, Ltd., will make the necessary increase of capital, and holders of ordinary shares in the company will receive a bonus of 2s. 6d. per share.

Proposed European Cable Syndicate.—It is stated that the idea of re-establishing the former Central European cable syndicate has been brought forward. A disposition to the joint regulation of prices is said to exist between makers in Hungary and Austria, but the cable works in Czecho-Slovakia have already declined to co-operate. An official proposal has so far not been placed before the German works, although it is considered that the syndicate of the latter will not readily surrender the position which it has regained in the world markets. The reconstitution of the international syndicate is said to be rendered difficult not only by the negative attitude assumed by the English cable makers, but also by so-called "dumping" by French firms as a result of the depreciated franc. The situation in the international cable market is characterised by the results of the recent competition thrown open by the Brussels city authorities, when the prices quoted showed a difference of up to 50 per cent., the lowest tender having been submitted by a German works (the Cologne Land and Marine Cable Company)

Disclaimer.—MESSRS. KERSHAWS, Cheetham Hill Road, Manchester, ask us to state that neither they nor their senior partner, Mr. A. Kershaw, are in any way connected with the firm of Kershaw & Wood which was mentioned in our "Bankruptcy Proceedings" last week.

Lead.—Messrs. James Forster & Co., reporting on March 13th, stated: "Closing prices yesterday were £31 11s. 3d. for March and £31 18s. 9d. for June, against £32 7s. 6d. and £32 11s. 3d. respectively at the end of last week. There is no material change in the position this week, except that supplies are not quite so plentiful as recently. However, prompt lead ex ship is easily obtainable, and there is a prospect of considerable arrivals of lead during the next six weeks. Consumption remains on a restricted scale in this country, while in Germany there is little or no improvement. The rate of consumption of lead in America has fallen from its recent high level, this being reflected in the constantly falling price in that country."

The Hiring of Apparatus.—The burgh electrical engineer of Greenock has sent us a copy of a pamphlet which is being issued to consumers—actual and potential—setting out the charges for the hire and hire-purchase of electrical apparatus. The Corporation's scheme covers cookers, fires, kettles, irons, and water-heating appliances and the terms are very reasonable.

Feed-Water Regulators.—During the past two months MESSRS. JAMES GORDON & CO., LTD., have received orders for over 70 equipments of Copes automatic feed-water regulators. Amongst these are included eight for the Oldham Electricity Works and eight for the Synthetic Ammonia & Nitrates Co., besides a number for export.

New Italian Companies.—Among the electrical companies recently formed in Italy are La Società per Intraprese Trazione Elettrica, of Asti, capital 75,000 lire; La Società Italiana per Istrumenti Elettrica Pizzi e Trovero, of Milan; La Società La Centrale per Finanziamente Imprese Elettriche, of Leghorn, capital 1,000,000 lire; La Società Lombarda Applicazioni Elettriche of Voghera, capital, 200,000 lire; La Società Astese Filovie Elettriche, of Asti, capital, 10,000 lire; La Società Radio-Elettro-Mecannica Bruno Bamoli & Co., Bologna, capital, 300,000 lire; La Società Industrie Elettriche Carolei (Cosenza), capital, 600,000 lire; and La Società Metallurgia-Elettrica, "S.I.M.E.," Milan.

Austrian Power Exhibition.—Arrangements are in progress for the holding of an "Energy Economy Exhibition" in Vienna in 1927. Sections will be provided for electricity, coal, gas, oil, and water power.

Trade Announcements.—MESSRS. WALKER, CROSWELLER AND Co. have removed from Strand, W.C.2, to 54-58, Queen Elizabeth Street, London, S.E.1. Telegraphic address: "Instrukemi, Boroh, London"; Telephone No.: "Hop 5786."

MESSRS. HAMNETT & ANDREW, insulating material manufacturers, have moved to larger premises at Devonshire House, Rusholme Road, Manchester. (Telephone: Ardwick 3802.)

MR. H. A. ANDREWS, formerly assistant engineer with Messrs. W. Coates & Sons, Dublin, and manager of the Electrical Department of Exchange Buildings, Dublin, has now commenced business as an electrical contractor at 17, Kildare Street, Dublin.

BROOKHIRST SWITCHGEAR, LTD., announces that it is transferring, at the end of the present month, its Birmingham office from Corporation Street to Essex House, Temple Street. Here, a fully-equipped showroom will be opened for the purpose of demonstrating the latest developments in its electrical control gear. The company already has showrooms in London and Glasgow. A showroom in Manchester will be opened shortly, and others are in preparation in Leeds, Bristol, &c.

ELECTRO-MECHANICAL SUPPLIES, LTD., Midland agents for the London Electric Wire Co. & Smiths, Ltd., have moved to larger premises at 44, Bayley Lane, Coventry.

THE BRITISH THOMSON-HOUSTON CO., LTD., has acquired new premises at 10 and 11, Snow Hill, Birmingham, to which the Birmingham branch will be transferred on March 22nd. A showroom is being arranged for the display of lighting fittings, radio apparatus, and domestic appliances. The telephone number is "Central 8301" and the telegraphic address "Asteroidal, Birmingham."

MESSRS. FREDK. THOMAS & Co. announce that the Castle Engineering Co., Ltd., is not now acting as their agent for Lancashire. The territory has been taken over by Messrs. P. Adair, Ltd., St. John Street Chambers, Deansgate, Manchester, who are carrying stocks of electric light fittings and alabaster bowls.

CAPT. I. MACKINTOSH, for the past six years technical assistant to Mr. G. Stephen Corlett, consulting engineer, has decided to commence practising on his own account. He is opening an office at Midland Bank Chambers, Wigan, and will be pleased to receive catalogues from manufacturers.

PHILIPS LAMPS, LTD., has opened a branch office at 16, Clarence Street, Belfast, to serve Northern Ireland.

TWISS ELECTRIC TRANSMISSION, LTD., has transferred its registered offices to Culford Works, Kingsbury Road, Dalston, N.1, thus consolidating the whole of the business in the premises acquired last November.

Catalogues and Lists.—MESSRS. L. G. HAWKINS & Co., LTD., 30-35, Drury Lane, W.C.2.—An illustrated folder describing the new "Universal" portable oven cooker.

MESSRS. PETTERS, LTD., Westland Works, Yeovil.—A well-illustrated catalogue of the company's 1926 models of oil engines, including generating sets.

THE HENDON ELECTRIC LAMP CO., LTD., 104, Southampton Road, W.C.1.—Two illustrated and priced leaflets dealing with an electric iron, and voltmeters and ammeters respectively.

MESSRS. GENT & Co., LTD., Faraday Works, Leicester.—Leaflet 85B, illustrating and describing the "Tangent" visible and audible staff locater.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1.—A pamphlet advertising "Duff" governor-controlled self-lowering jacks.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Five priced and illustrated booklets dealing respectively with the "Cosmos" home iron; electric lighting fittings; shop-window reflectors; "Cosmos" fires; and automobile and battery lamps.

MESSRS. W. CHRISTIE & GREY, LTD., 4, Lloyd's Avenue, E.C.3.—A pamphlet dealing with the prevention of the transmission of noise and vibration.

THE PERRY PREHEATER CO., Imperial Buildings, 56, Kingsway, W.C.2.—A pamphlet containing full details of the "Perry" system of preheating air by the use of waste gases.

THE ROYAL INSURANCE CO., LTD., 1, North John Street, Liverpool, has issued a 1926 edition of its illustrated motor insurance pamphlet: "Road Risks Illustrated."

THE WEINBAU INCANDESCENT & ELECTRICAL CO., 327-335, Commercial Road, E.1.—A net trade price list of electrical supplies.

MR. J. H. HEATHMAN, Parson's Green, Fulham, S.W.6.—Illustrated leaflets advertising ladders, trucks, fire-fighting accessories, &c.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A folder advertising the company's "easy-to-read" dial thermometers.

FOSTER INSTRUMENT CO., Letchworth, Herts.—Catalogue No. 42, a brochure dealing with pyrometers of various types, including methods of using them. Fully illustrated.

MOULDENSITE, LTD., Darly Dale, Derbyshire.—A catalogue of plastic moulding preparations, impregnating varnishes and enamels, lacquers, cements, &c.

THE KARTRET SWITCHGEAR CO., LTD., 7, Carteret Street, Broadway, S.W.1.—A well-illustrated catalogue containing particulars and prices of the company's switch- and fuse-gear.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—March stock list of motors and dynamos.

MESSRS. J. J. EASTICK & SONS, 118, Bunhill Row, E.C.1.—An illustrated pamphlet describing "Eelex" standardised plugs and sockets for radio connections, terminals of various kinds, coil holders, h.p. batteries, frame aerials, &c. Priced.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A catalogue of electric lighting accessories and pamphlets dealing with a hole cutter and switch- and fuse-gear. Illustrated and priced.

Deeds of Assignment.—R. E. LOWES, electrical and radio engineer, Victoria Chambers, Laura Street, Sunderland.—Particulars of claims to the Trustee, Mr. A. J. Gray, 3, Manor Place, Sunderland.

A. G. SMITH, electrician, 122, Titchfield Street, Kilmarnock.—Particulars of claims to the trustee, Mr. J. A. Carson, 8, Duke Street, Kilmarnock, by March 27th.

Bankruptcy Proceedings.—C. G. HOFMAN (trading as W. J. Chambers & Company), radio component manufacturer and electrical engineer, Cowthorpe Street, Wandsworth.—An application for an order of discharge was made on March 5th, to Mr. Registrar Francke, at the London Bankruptcy Court, on behalf of this bankrupt, who failed last July, with ranking liabilities of £3,497 and assets of £192. The failure was attributed to ill-health and consequent falling away of business and to lack of capital. The discharge was granted subject to a suspension of two years.

J. F. CARR, 89, Aston Avenue, Fallowfield, Manchester, electrical goods agent.—The public examination of this debtor was held on March 12th at the Court House, Manchester. The statement of affairs showed ranking liabilities of £1,995, while the assets, amounting to £32, were insufficient to cover the balance due to secured creditors. The examination was closed.

W. N. SMART, electrician, late of 17, 19 and 19a, Cross Street, Oldham.—Receiving order made March 5th, on debtor's own petition.

YOULL, FRASER & Co., LTD., electric lamp factors, Bertram Chambers, 6, Hunter Street, Liverpool.—Receiving order made March 4th, on creditor's petition.

H. TIDSWELL (H. Tidswell & Co.), electrical engineer, 11, Bazaar Street, Pendleton.—Receiving order made March 6th, on debtor's own petition.

H. R. ALTHORP, electrical engineer and contractor, 13, Wellington Crescent, Shipley, Yorks.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released February 25th.

H. A. BIRLESON (Birleson & Co.), electrical engineer, Clarence Buildings, Fazackerley Street, Chorley, Lancs.—Trustee, Mr. H. Parker, 11, Winckley Square, Preston, released February 26th.

S. J. WATSON, lately carrying on business with H. Rothwell and F. C. Jinks, as The Vulco Magneto Co., 11, Long Acre, W.C.—Last day for proofs for dividend, March 27th. Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C.

J. HUMPHREYS, plumber and electrical engineer, the Yard, behind the Plough Inn, Oldham Road, Rochdale.—Last day for proofs for dividend, March 24th. Trustee, Mr. J. G. Grant, Official Receiver, Byrom Street, Manchester.

J. A. A. BARDSLEY, electrical contractor, 91, Old Hall Lane, Withington, Manchester.—Receiving order made March 8th on debtor's own petition.

A. RICHARDSON, electrical engineer, 36, School Road, Sale, Chester.—Receiving order made March 8th, on debtor's own petition.

G. R. SPARROW, electrical engineer, late of 6, Trelawn Road, Brixton, S.W.—Receiving order made March 8th, on debtor's own petition

W. M. HORSFALL, electrical engineer, 7, Redcross Street, Liverpool.—Second dividend of 5½d. in the £, payable March 19th, at the offices of the Official Receiver, 11, Dale Street, Liverpool.

S. A. WARDELL, electrical contractor, 83, Raleigh Road, Richmond, Surrey.—First and final dividend of 3½d. in the £, payable March 29th, at the office of the Official Receiver, 29, Russell Square, W.C.1.

S. H. BARDWELL (Bennett, Bardwell & Co.), electrical engineer, 22, Church Street, Basingstoke.—First and final dividend of 5s. 11½d. in the £, payable March 24th, at the Official Receiver's Office, Midland Bank Chambers, High Street, Southampton.

Company Liquidations.—GAS AND ELECTRIC SECURITIES, LTD., 14 and 16, Cockspur Street, S.W.—Under the compulsory liquidation of this company, accounts have been lodged showing total liabilities of £19,512 (unsecured £18,293), assets valued at £2,521, and a deficiency of £15,824, with regard to contributories, the issued capital being only three ordinary shares of £1 each. Mr. E. T. A. Phillips, Official Receiver and Liquidator, reports that the company, which was promoted by Mr. F. W. Salisbury-Jones, was registered as a private company

on February 2nd, 1923, with a nominal capital of £1,000, and was formed to deal generally in securities and investments of every kind. No business was done until August, 1923. The failure of the company is, in the opinion of the Official Receiver, due, generally, to the fact that it had not in reality any independent existence and particularly to its assumption of liability in connection with another company.

Charles Bell, Ltd., electrical and mechanical engineers, Bradford.—A meeting of creditors was held recently, at the offices of Mr J. Lund, Darley Street, Bradford, the liquidator appointed in the voluntary liquidation of the company. A statement of affairs was submitted which disclosed liabilities of £6,733, all due to unsecured creditors. The net assets amounted to £3,135, leaving a deficiency as regarded the creditors of £3,598. The issued capital amounted to £12,003, so that there was a total deficiency of £15,601. A deficiency account was submitted which showed that there had been a loss of £9,011 on the trading from January 1st, 1922, to February 13th last. The liquidator reported that the business was commenced in 1874 by Mr. Charles Bell. He died in 1890, and his two sons, Lazarus Bell and T. Bell, continued. The latter died in 1916 and the business was then continued until 1921, when the company was formed The trading had resulted as follows: 1917, profit of £3,466; 1918, profit of £1,164; 1919, loss of £776; 1920, profit of £2,594; and 1921, profit of £1,277. The company took over the business in December, 1921, and at that time the business had a capital of £12,000, after taking into consideration £4,000 in respect of goodwill. The account for 1922 disclosed a turnover of £25,000 and a loss of £1,888. For the following year the turnover was £16,467, and there was a loss of £1,119. In 1924 the turnover was £17,471, and the loss £1,718, and for 1925 there was a further loss of £3,526, on a turnover of £17,592. The accounts to February 13th last showed a further loss of £758. It was decided that application should be made to the Court for the appointment of Mr. S. S. Tadman as joint liquidator with Mr. Lund, and a committee of inspection was also nominated. The following are creditors:—

	£		£
Bradford Corporation	116	Dawson, F.	159
Brocklehurst, W. H.	150	Taylor & Son, J.	208
British Thomson-Houston Co., Ltd.	141	Dyson, J.	412
British Insulated Cables, Ltd. ...	104	Scattergood & Johnson	511
Liverpool Electric Cable Co., Ltd.	132	Douthwaite, L. W.	577
Baxendale & Co., Ltd.	373	Dixon, Powner & Co.	72
Bottomley, T. A.	78	Electromotors, Ltd.	68
Bell, Lazarus	580	Philips Lamp Co., Ltd.	135
Bell, Leonard	125	Falk, Stadelmann & Co., Ltd....	60
Casperson, G.	61	General Electric Co., Ltd. ...	74
Cryselco, Ltd.	95	Laidlaw & Robson	67
Inland Revenue	721	Greatorex, Saml., & Co.	74
Watford Lamp Co.	118	W. T. Henley's Telegraph Works Co., Ltd.	390
		Igranic Electric Co., Ltd. ...	87

Oco Electrical Appliances, Ltd.—Winding up voluntarily. Liquidator, Mr. C. D. Britten, Prince's Chambers, 16, John Dalton Street, Manchester. A meeting of creditors was called for March 15th; particulars of claims to the Liquidator by April 20th.

"Radioelectric," Ltd.—A meeting of members is called for April 12th, at the offices of Messrs. Reeve, Parker & Co., 2, Coleman Street, E.C., to hear an account of the winding up from the Liquidator, Mr. A. G. Parker.

Pressland Electric Supplies, Ltd.—A petition for the winding up of this company has been presented to the County Court of Surrey by Burndept Wireless, Ltd., of Aldene House, Bedford Street, Strand, W.C., creditors, and will be heard at Kingston-on-Thames on April 30th.

Lyme Regis Electric Light & Power Co., Ltd.—A meeting of members is called for April 13th at Basildon House, Moorgate, E.C.2, to hear an account of the winding up from the Liquidator, Mr. L. W. Hawkins.

Ingleby & Co., Ltd., Leeds.—First and final dividend of 6½d. in the £.

County of Dorset Electric Supply Co., Ltd.—A meeting of members is called for April 13th, at Basildon House, Moorgate, E.C.2, to hear an account of the winding up from the Liquidator, Mr. L. W. Hawkins.

Electrolite, Ltd.—Mr. T. Gourlay, Official Receiver and Liquidator, 29, Russell Square, W.C., released March 9th.

Northumberland & Durham Radio Engineering Co., Ltd.—A meeting of members is called for April 9th, at Bank Chambers, 24, Grainger Street West, Newcastle-on-Tyne, to hear an account of the winding up from the Liquidator, Mr. J. Mitchell.

Private Arrangements.—J. E. Kimber and J. Kimber, lately trading as S. Kimber & Sons and The Croydon Electric Co., late of 81 and 81a, Whitehorse Road, Croydon, electrical engineers and jobbing builders.—A meeting of the creditors of the above was held recently at the offices of Messrs. Brown, Peet and Tilley, C.A., Mark Lane, E.C., when the chair was occupied by the representative of the Credenda Conduits Co., Ltd., the largest trade creditors. A statement of affairs was presented as at January 31st, which showed liabilities of £2,155, all due to unsecured creditors. There was a fully secured creditor for £650, and the security held totalled £1,000. The net assets were £1,078, leaving a deficiency of £1,077. Mr. Peet said that the debtors carried on two businesses, one an electrical business and the other that of jobbing builders. The electrical business was commenced about 2½ years ago. According to a profit and loss account, for the year ended December, 1924, there was a net profit on the electrical side of £209 and a loss of £31 in connection with the building business. Mr. Peet said that there were no accounts for 1925, but according to information received the sales for the electrical business only were £4,200 and the gross profit was £819. The net profit, if any, could not be ascertained. Continuing, Mr. Peet said that the debtors disposed of the business at the beginning of the year for £300, being heavily pressed by creditors. During the month of February the business had been carried on by the new owner, but Mr. James Kimber had signed orders for goods and some of the creditors present did not know that the business had been disposed of at the time the orders were given. Mr. Peet had been approached by a gentleman who was prepared to assist the debtors by making an offer of 5s. in the £. After some discussion Mr. C. Latham proposed that an offer of not less than 10s. in the £ should be paid within fourteen days, or that the purchaser should surrender the assets on equitable terms, failing which the estate should be dealt with in bankruptcy. The resolution was carried. It was also resolved that a committee should be appointed, consisting of three of the creditors, with power to recommend the acceptance of any proposals in the foregoing resolution, or any modification thereof. The committee consisted of the representative of Credenda Conduits Co., Ltd., Mr. King, and Mr. C. Latham. The following are creditors:—

	£		£
Eaton & Sons	43	Wardle Engineering Co.	30
Credenda Conduits Co., Ltd. ...	253	Wenham Lighting Co.	32
Seraphan & Wood	53	Lighting, Heating and Glass ...	50
William King	176	Edison Swan Electric Co., Ltd....	40
Vulcan Electric Co.	59	Sanders & Co.	97
Metallic Flexible Tubing Co. ...	103	Harris & Bailey	48
Cable Accessories Co., Ltd. ...	131	Stantons, Ltd.	23

Domestic & General Electrical Co., Ltd., Hampden House, Kingsway, W.C.2., electrical engineers.—A meeting of the creditors was held on March 10th. No statement of affairs was presented, but the secretary of the company said that the liabilities amounted to approximately £458 and the assets totalled £251. The company was incorporated in December, 1924, with a nominal capital of £1,000, of which £150 was put up in cash. The company took over the business from a Mr. Purdie, and paid as consideration £500, for which shares were taken. The creditors passed a resolution requesting the shareholders to meet at the earliest opportunity and pass the necessary resolution for voluntary liquidation and they recommended that Mr. W. Osborne, of Messrs. Corfield and Cripwell, Balfour House, E.C., should be appointed liquidator in the voluntary liquidation of the company. The following are creditors:—

	£		£
General Electric Co., Ltd. ...	92	Robert Hornby, Ltd.	53
St. Helens Cable Co., Ltd. ...	66	"The Power Laundry"	47
Macintosh Cable Co., Ltd. ...	26	Capel & Co., Ltd.	52
Sun Electrical Co., Ltd. ...	29	Purdie, H. A.	26

F. R. Hodges and S. V. Styles, trading as The Yorkshire Electric Supplies Co., Canning Street, Hull.—A meeting of creditors was held recently at Hull, when a statement of affairs was presented, which showed liabilities of £672, all due to unsecured creditors. The assets were estimated to produce £534, leaving an estimated deficiency of £138. It was resolved that the estate should be dealt with under a deed of assignment in favour of Mr. H. E. Pettingell, accountant, Hull, and Mr. P. Hodgkinson, accountant, Bradford, as joint trustees. The following are creditors:—

	£		£
Ace Battery Co.	25	Edison Swan Electric Co., Ltd.	66
General Cable Manufacturing Co., Ltd.	251	J. Dyson	70
J. H. Stewart & Co., Ltd. ...	50	Chloride Electrical Storage Co., Ltd.	37

Dissolution of Partnership.—Crockatt & Co., electrical engineers, 182, West George Street, Glasgow.—Mr. H. A. McQueen and Mr. G. B. Crockatt have dissolved partnership. Mr. McQueen will attend to debts and carry on business on his own account as H. A. McQueen & Co. at 182, West George Street. Mr. Crockatt will shortly commence business as Crockatt & Co. at an address to be intimated.

Our Foreign Trade.—February Figures.—The following were the values of imports and exports of electrical goods and machinery during February, 1926:—

	Feb., 1926.	Inc. or dec.	2 months, 1926.
Imports.	£	£	£
Electrical goods and apparatus	252,042	− 91,586	−172,534
Machinery	945,542	+ 10,750	+ 62,742
(Electrical machinery) ...	52,034	− 19,749	+ 470
Exports.			
Electrical goods and apparatus	987,494	+ 24,409	−242,092
Machinery	4,207,786	+319,159	− 54,364
(Electrical machinery) ...	521,048	+106,520	+ 8,812
Re-export.			
Electrical goods and apparatus	15,218	− 11,856	− 21,762
Machinery	96,334	− 23,683	+ 2,961
(Electrical machinery) ...	4,719	+ 1,160	+ 414

New French Company.—A new company has recently been formed in Paris (13, Rue de Quatre Septembre) with a capital of 500,000 fr. and the title La Société Electro-Chimique "Phoebus," to manufacture dry batteries and electro-chemical apparatus.

Local Exhibitions.—BRIDLINGTON.—An electrical exhibition was opened by the Mayor on behalf of the Corporation at the Victoria Rooms, Bridlington, on March 8th.

EVESHAM.—The Shropshire, Worcestershire, and Staffordshire Electric Power Co. is holding a demonstration of electric service for the home and business, at the Public Hall, Evesham, from March 22nd to 27th inclusive.

KEIGHLEY.—The Corporation Electricity Department is to hold a public exhibition of electrical appliances at the Municipal Hall, from April 12th. Leading British electrical firms and some American producers will be among the exhibitors.

Book Notices.—"Sell's Directory of Registered Telegraphic Addresses." Pp. 2,944. London: Business Dictionaries, Ltd. Price 45s.—This is the forty-first edition of this very useful guide, which is compiled from information received by the General Post Office. The original edition contained about 40,000 names; there are now 100,000, and the classified trades section has expanded correspondingly. In addition to the main object of the publication, a great amount of other useful commercial information is included.

"*The Engineer* Directory and Buyers' Guide, 1926." London: The Engineer, Ltd.

"Military Engineering" (Technical Training). Vol. II: Electrical Engineering.—A set of some 70 amendments to this volume has been issued by the War Office, and can be obtained from H.M. Stationery Office, price 2d. net.

"*The Transactions* of the South African Institute of Electrical Engineers." Vol. XVI, Part 12. January, 1926. Price 2s.

For Sale.—Bexhill Corporation Electricity Department has for disposal four Babcock & Wilcox boilers, two condensers, two Weir pumps, induced draught plant, &c. Messrs. Allan Arthur & Ure invite offers for a duplicate electric lighting and power generating plant now in use in Ireland. Manchester Corporation Electricity Department has for disposal six induction motor-generating sets. Aberdeen Corporation Electricity Department invites offers for two 250-kW and one 100-kW Peebles-La Cour motor converters, one 30-kW Westinghouse motor-generator, six 220-V d.c. motors, &c. (See our advertisement pages to-day.)

Radio Development in Ecuador.—*Commerce Reports* quotes an "unofficial" statement to the effect that the Government has approved the proposal of a Guayaquil firm granting it the exclusive right to import radio-telephone apparatus for a period of five years, and to erect broadcasting stations at Quito and Guayaquil. The net profits accruing are to be divided equally between the concessionaires and the Government.

The A.E.G. Report.—Supplementing the information given in our issue of February 19th concerning the activity of the Allgemeine Elektricitäts Gesellschaft during the year ended September 30th, 1925, we find from a copy of the report which is now available that the directors state that the conditions of the times are difficult and the future cannot be foreseen. Although the necessity for electrification throughout the world is no longer in doubt and the electrical industry is therefore in a better position than many other industries, it is naturally dependent upon the general economic situation both in Germany and abroad. Exportation is difficult and rendered unprofitable by the protection policies of over-industrialised countries. In oversea countries the competition of all other countries is being experienced. On the other hand, Russia is a promising market, but the business can only be extended gradually and in accordance with the availability of funds in that country. Dealing with the company's activities, the report states that among the orders executed by the large machine works was one for four 29,000-kVA, 12,000-V generators for Norway, which were the largest machines hitherto produced. In the Oberspree cable works extensions of the plant were made for the manufacture of telephone and telegraph cables, although a good demand also prevailed for light and power cables. The manufacture of 60,000-V cables according to the principle of "metallised cores" was taken up and the production of larger cable lengths undertaken. The development of long-distance cables made notable progress in both the technical and economical respects. Concerning the turbine department the report states that it was possible to increase the size of turbo-generators running at 3,000 r.p.m. to 30,000 kVA. In central station work the most important order was one from the Berlin municipal electricity supply works for the establishment of a complete power station at Rummelsburg of an initial capacity of 240,000 kW. In this station there will be installed three generating sets. Steam will be supplied by 16 boilers fired with pulverised coal. Transformers will be installed to step up the pressure from 6,000 V to 30,000 V. After referring to other turbo-dynamo equipment in hand the report mentions that orders have been received for h.p. transformers up to an individual capacity of 44,000 kVA, while the total capacity of the transformers ordered in 1924-25 exceeded 1,000,000 kVA, and contracts were also booked for extensive switching installations for power and converter stations for pressures up to 100,000 V. In the electrical distribution branch the company carried out for various undertakings the construction of h.p. long-distance lines and the selective protection afforded by the Biermann distance relay was put into service in numerous cable and overhead line networks and had fulfilled expectations. The report also refers to orders on hand for ships' plant of a total of 50,000 h.p.; the construction for the Phœnix Steel Works of a reversing train drive of a capacity of 25,000 h.p. for the ingot mill at Ruhrort, which is more powerful than any hitherto carried out; and orders for electric steel furnaces on the Fiat system representing a total of 64,000 kVA.

The Value of Trade Fairs.—Modern fairs and exhibitions differ widely in outward appearance from those of the Middle Ages, but the fundamental aims and methods of their conduct remain much the same. Although the development of transportation and other means of communication has tended to limit somewhat the importance of fairs as media for the distribution and sale of certain commodities, such as raw materials, they continue to be important in the distribution of manufactured articles and in the dissemination of advertising propaganda. New lines are quickly introduced at fairs and exhibitions, and the manufacturer is enabled to determine the market possibilities of his product at a minimum cost and with the least possible delay.—*Commerce Reports.*

The Newcastle Lighting Service Bureau.—The North-East Coast Lighting Service Bureau is doing very satisfactory work at Newcastle. Considerable interest has been aroused in the district and lectures are being attended by institutions and associations of various kinds, chambers of trade, shopkeepers, domestic science students, &c. During last week an exhibit was made at an electrical exhibition at Thirsk. We reproduce herewith a photograph of the lecture room at the Bureau.

Lecture Room at the Newcastle Lighting Service Bureau.

Jugo-Slavian Electrical Imports.—The total importation of electrical machinery into Jugo-Slavia during 1924 was valued at approximately £267,000.

The Italian Electrical Market.—The French Commercial Attaché in Italy has been investigating the prospects for the sale of electrical machinery and apparatus in that country, and the results of his inquiries were the subject of a recent article in the *Moniteur Officiel du Commerce et de l'Industrie*. The following is a summary of some of the chief points of the report:—

The Italian electrical manufacturing industry, although it has improved its position during the past few years, is not very prosperous. It uses a large quantity of sheet iron, steel, and special castings, on which, in many instances, import duties are levied. As a result, the industry pays dearly for much of its raw material. The comparatively strong position of the wire and cable makers who employ little iron or steel is quoted as evidence of the burden which the heavy electrical industry has to bear owing to the import tariff. Consequently the Italian builders of large generators and motors do not find it easy to quote competitive prices, and Germany has been rapidly regaining her position in the Italian market, which was temporarily held by Great Britain and the United States.

Two German electrical manufacturing firms have reopened branches which were closed during the war, and are now able to give quick deliveries. There is a good sale for motors suitable for textile mills. At the same time, the exports of generators and motors have been increasing.

Italy's imports of transformers are considerably in excess of her exports. In 1925 (seven months) 783 tons came in from abroad, compared with 666 tons in the previous twelve months, whilst exports totalled only 99 tons during the seven months, as against 177 tons in the year 1924 and 359 tons in 1923. Prior to 1920 no exports were recorded. There is a growing importation of accumulators, but a decreasing exportation. Numbers of Italian makers have specialised in the production of accessories, such as switches, valves, and regulators. Imports of measuring instruments are, however, large. Italy is a large producer of copper conductors, plates, and bars for electrical purposes, imports being to a large extent restricted to material supplied to concerns in Italy under the control of foreign capital. Nickel-chrome wires and plates

are supplied by Great Britain and the United States, with a good deal of competition from Germany. France also has hopes of capturing some of this trade. In insulated wires, importation is difficult in the face of the home production. About 1,500 tons of porcelain insulators were imported last year, against 2,290 tons in 1924, Germany being the chief supplier.

The Leipzig and Cologne Fairs.—*Reuter* reports that the number of visitors to the Leipzig Fair considerably exceeded expectations, being estimated roughly at 140,000, including 20,000 foreigners. The number of exhibitors amounted to 10,300. The business done turned out in many branches substantially better than had been hoped in view of the economic situation. In particular, the export business in the technical section and in china, glass, stone and wooden goods was in some cases fairly good. Home trade, at any rate so far as the main articles of consumption were concerned, still showed a quiet appearance, which was attributed to unemployment and the country's poor purchasing power. On the other hand, a later report states that an official notice issued by the management of the Cologne Fair says:—"As the Leipzig Fair has served only to confirm the prevailing export crisis in German industries, the Spring Fair in Cologne will be cancelled. Only one fair will be held in 1926, the Autumn Exhibition, opening on September 12th and continuing till September 19th."

Chinese Notes.—The Foochow Electric Co. is installing a suburban lighting system extending from the company's station to Tamensiang, Siaomensiang, Howyusiang, Kushan, and Kweikisiang. The last place is 20 li (about 7 miles) from Foochow.

Work has been commenced upon a telephone service between Shanghai and Sungkiang, a distance of 21½ miles, and is expected to be completed during April or May.

Twelve Years at the Equator.—The Sultan of Zanzibar has had a Hart electric lighting battery in use at the Royal Palace for the past twelve years. It is noteworthy that a battery should continue to give satisfactory service after a long period so near to the Equator.

Lighting and Power Notes.

Amble.—Electricity Charges.—The Urban District Council is to introduce the following new tariff for heating and cooking:—A fixed charge of 20s. for each winter quarter and 10s. for each summer quarter, plus 1d. per kWh for all electricity consumed. The charge for lighting is to be reduced by 1d. per kWh as from April 1st next.

Australia.—Corowa (N.S.W.).—The electricity supply for the district was formally inaugurated by Sir J. Monash, chairman of the Victorian Electricity Commission, on February 1st. This marks an important stage in the development of the Yallourn scheme, the distance from the point of generation at Yallourn to the distributing area in New South Wales being 277 miles. The transmission line to Albury is nearing completion. The length of the line will be 290 miles.

Bacup (Lancs.).—Electricity Extensions.—The Town Council proposes to borrow £13,000 for mains and services.

Barnes.—Electricity Extensions.—The electrical engineer has submitted to the Urban District Council a programme of e.h.p. and l.p. feeder and distribution main extensions to be carried out during the forthcoming summer, involving an expenditure of £11,126.

Beckenham.—Electricity Supply.—At a recent meeting of the Electricity Committee the electrical engineer reported that within the next year it would be necessary to install additional turbine plant, but before the necessary sanction was obtained it was incumbent upon the Council to inquire of the Joint Electricity Authority whether it was in a position to afford a partial or bulk supply on more advantageous terms. The Committee has authorised its officials to make the necessary inquiry.

Electricity Charges.—The Committee has agreed that power consumers shall be allowed to consume an equivalent of 10 per cent. of their quarterly power consumption for lighting at power rates provided that the power consumption during the quarter is not less than 2,000 kWh.

Bristol.—Electricity Extensions.—In consequence of the increasing demand for electricity at Avonmouth, the Corporation Electricity Committee states that it is necessary to lay additional mains or to raise the pressure of the existing ones, and has recommended that the pressure from Feeder Road be raised to 11,000 V. The cost of transformers, switchgear, and equipment necessary amounts to £24,300, to which must be added the sum of £17,687 for connecting up the existing distributing centres in accordance with the model scheme, making a total of £41,987. The Committee also reports that it is necessary to increase the pressure of certain feeders between Feeder Road and the Ashton district from 6,000 V to 11,000 V. The estimated cost of the work is £2,941. The Committee has recommended that the works be carried out and that it be authorised to apply for sanction to the borrowing of £41,987 and £2,941 respectively.

Continental.—Denmark.—*Commerce Reports* states that there were 479 power stations operating in Denmark during the fiscal year 1923-24, according to a recent survey prepared by the Danish Statistical Department. Of these 121 were city plants and 358 were situated in rural areas. Although practically all of the city plants were constructed prior to the war, nearly one-third of the rural plants were erected during or since the war. The capacity of the plant installed increased from 190,000 to 228,000 h.p. during 1923-24. Of this increase steam installations accounted for 26,000 h.p. and Diesel plant for 12,000 h.p. During the year under review the output amounted to 231,000,000 kWh.

Spain.—The Barcelona correspondent of the *Daily Mail* reports that the Minister of Public Works states that 14,000,000 h.p. is available in the River Ebro basin and the State will undertake works which will make the river navigable, harness the water, and irrigate lands. The Government will spend 300 millions spread over ten years, with the object of obtaining more than 1,000,000 h.p. and enabling 2,000,000 acres to be irrigated. The electrical energy will be used for railway electrification.

Czecho-Slovakia.—According to *Commerce Reports* there was increased activity on the part of the Government and the municipalities of Czecho-Slovakia in the development of the water-power resources of the country during the past year. The 1926 programme of the Ministry of Public Works includes the completion of the hydro-electric stations in Nymburk, Kolin, Prelouc, and Mirejovice, as well as the construction of a reservoir on the Elbe near Verde, and the building of a dam and a hydro-electric station in Uzhorod. Other work will also be undertaken in various sections of the Republic. An appropriation of 25,000,000 crowns has been set aside for this work.

France.—A concession has recently been granted for the establishment of a hydro-electric station at La Llau in the Eastern Pyrennees to utilise the water power of the River Coumelade.

Italy.—Concessions in respect of new hydro-electric stations have recently been granted to a syndicate at Civetella Roveto (province of Aguila) to utilise the water power of the River Fucino to the extent of 10,250 h.p. and to the Società Idroelettrica Cisalpina to utilise the River Mara to the extent of 29,960 h.p. at Villa di Chiavenna (Sondrio province).

It is reported from Rome that in order to encourage the more rapid development of the hydro-electric resources of Southern Italy, Sicily and Sardinia, the Italian Government proposes to grant a subsidy of 60 lire per nominal h.p. in respect of any new power stations put in hand before the end of 1928. A subsidy of 40 lire per h.p. is also to be offered in respect of new hydro-electric plants in other parts of the country.

Dewsbury.—Electricity in Bulk.—The Town Council has decided to take a bulk supply of electricity from the Yorkshire Electric Power Co. for the Ravens Lodge housing site.

Doncaster.—New Plant.—The Town Council has approved a scheme submitted by the Electricity Committee for extensions to the generating station, including the provision of a 6,000-kW turbo-generator with condensing plant, &c., boiler house extensions, water tube boilers and high-pressure switchgear and cables, at an estimated cost of £57,135; and a 1,000-kW converter with h.p. and l.p. switchgear and cables (£5,915). Application is to be made for sanction to the borrowing of these sums for the purposes mentioned.

East Ham.—Electricity Extensions.—The Electricity Committee is to lay two feeder cables to Manor Park at an estimated cost of £14,500.

Gravesend.—New Electricity Charge.—The Corporation has approved a recommendation of the Electricity Committee that from January 1st, 1926, the following new tariff shall be introduced:—A fixed quarterly charge of 1/40th of the annual rateable value of a house, plus ¾d. per kWh for all electricity consumed.

Loan Sanctioned.—The Corporation has received sanction to a loan of £40,000 for plant extensions at the electricity works.

Holbeach (Lincs.).—Electricity Scheme.—The Urban District Council has approved a draft agreement with the Boston and District Electric Supply Co., Ltd., for a supply of electricity to the town. The Council has an option to purchase the undertaking at the end of 21 years.

Irish Free State.—Castlerea (Co. Roscommon).—The town is without street lighting as the Castlerea Lighting & Milling Co. has declined to light the street lamps any longer at a loss. The ratepayers paid 6d. in the £ to defray the cost of the public lighting, while the sum of £60 was contributed for the purpose by the Castlerea Power Trustees annually. The contract with the company for the lighting of the street lamps was £130 a year. The trustees are not now in a position to contribute more than £20 a year, and the ratepayers decline to pay more than 6d. in the £. The company states that it was carrying out the lighting of the streets at the minimum figure, and could not now do so at a loss of £40 a year.

Leeds.—Loans.—The Corporation Finance and Parliamentary Committee has under consideration a recommendation of the Electricity Committee that sanction be sought to borrow £50,000 for sub-station equipment and £10,000 for the erection of a new sub-station.

Lincoln.—Loan.—The Town Council has applied for sanction to a loan of £17,400 for electricity purposes.

Liverpool.—Electricity Supply Progress.—Members of the Electric Power and Lighting Committee recently inspected the Lister Drive power station and saw the buildings being prepared for the reception of five new turbo-alternators, one of which, rated at 25,000 kW, is now in service. The cost of the work, when completed, apart from the machinery, will be

£500,000. The chairman of the Committee stated that additional demands received during the past month for electricity for lighting, heating, cooking, &c., had averaged 1,000 kW per fortnight. There were now 1,344 cookers in operation. During the past six months 550 extensions of mains had been approved at an estimated expenditure of £140,000, while £30,000 had been approved for h.p. mains and £75,000 for mains on housing estates. The number of consumers connected was 41,160, and total connections, excluding tramways, were equivalent to 110,195 kW.

London.—HAMMERSMITH.—The Electricity Committee has recommended to the Borough Council that the following two alternative schemes for the wiring of premises be adopted:—(a) Hire scheme: A fixed quarterly charge varying from 3s. 6d. for 4 points to 9s. for 16 points for lighting supply, and from 2s. 6d. for 1 point to 7s. for 5 points for power supply. (b) Hire purchase scheme: A fixed quarterly charge based on actual cost of installation, plus 10 per cent., together with interest at 5 per cent., per annum, on balance outstanding. The standard rates for electricity consumed will be charged in addition to the fixed quarterly charges. The Committee has also recommended that a sum of £1,000 be set aside out of the accumulated profits of the undertaking for financing the scheme.

ST. PANCRAS.—The Electricity and Public Lighting Committee has considered a report from the borough electrical engineer on proposed additional plant to meet the increased demand for electricity, and has recommended to the Borough Council that the consent of the Electricity Commissioners be obtained to the installation of three 2,500-kW motor converters and one 10,000-kW generating set, with accessories, at a total estimated cost of £72,500; the provision of an additional sub-station at an estimated cost of £25,000; and that £2,500 be provided for contingencies in connection with the sub-station. The Committee has also recommended that the Crown Estate Paving Commissioners and H.M. Office of Works be informed that the Council is prepared to provide, maintain, and light 176 street lamps in the neighbourhood of Regent's Park and Primrose Hill, at an annual charge of £4 7s. 6d. per lamp, subject to an agreement being entered into covering a period of 10 years. The estimated capital cost of the scheme is £3,135.

Newport (Mon.).—WIRING OF SMALL HOUSES.—The Electricity Committee has adopted a scheme of assisted wiring for small houses submitted by the electrical engineer.

METER RENTAL CHARGES.—The Committee has also approved a recommendation that the meter rental charges for lighting be reduced to pre-war basis, and that the meter rental charges for heating and cooking purposes be discontinued.

Normanton.—LOAN.—The Urban District Council is applying for sanction to a loan of £15,600 for sub-station plant, mains, services, and meters.

Northern Ireland.—COLERAINE (CO. LONDONDERRY).—The Urban District Council has decided to apply for sanction to a loan for £22,000 for an electricity scheme for the town, and an agreement is to be drawn up with Mr. A. Leigh, consulting engineer.

Padiham.—ELECTRICITY IN BULK.—The Town Council met recently to decide upon the operation of the Electricity Order. Mr. Wood, electrical engineer, of Bolton, attended, and he advised on three alternative schemes. The Council decided to take a supply in bulk, and to carry out the distribution of electricity itself.

Preston.—ELECTRICITY SUPPLY.—At a meeting of the Town Council on March 11th, consideration was given to the question of a transmission line between Preston and Blackpool and the Council confirmed a resolution that the cost of this line should be increased from £66,000 to £87,500. The Chairman of the Electricity Committee said the first scheme was to give effect to a load of 10,000 kW. At that time the Blackpool station was becoming loaded up and the demand for electricity on the coast was increasing. Difficulties had been overcome and an agreement had been arranged with Blackpool for the next 20 years which provided that the seaside town should take at least 5,000 kW. With a possibility of growth, Preston was faced with the alternative of having to duplicate its line within a few years, and so it had decided to make better provision at the present time. The ultimate total cost would reach £125,000 but this would be the only expenditure required for some years, and Blackpool was willing to pay half the extra cost.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

MONAGHAN.—Lighting: From 1s. 2d. to 1s. per kWh.
EAST HAM.—Private lighting: From 6½d. to 6d. per kWh.
SALFORD.—Power: A reduction of approximately 8 per cent.
DOVER.—Lighting: From 8½d. to 7½d. per kWh.

Sandwich.—ELECTRICITY SUPPLY.—The Town Council is to approach Messrs. Pearson & Dorman Long, Ltd., with regard to a supply of electricity for the town from the power station at Stonar.

Scarborough.—ELECTRICITY SUPPLY.—The Council is to apply for powers to supply electricity for all purposes within the borough and adjacent districts. The maximum price for electricity is to be 10d. per kWh.

Spalding.—ELECTRICITY SUPPLY.—The Boston and District Electric Supply Co., Ltd., has offered to give the Urban Council a supply of electricity in bulk at £4 10s. per kVA of maximum demand per annum, plus .75d. per kWh. This offer is to be considered by the consulting engineer, together with one from the Peterborough Corporation.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following: The Weston-super-Mare and District Electric Supply Co., Ltd., for the supply of electricity in the parish of Uphill; Mr. J. A. Purves, for the supply of electricity in the urban district of Burnham-on-Crouch, and certain parishes in the rural district of Maldon.

The Gainsborough Urban Council has received intimation from the Electricity Commissioners that its application for a Special Order has been granted.

West Bromwich.—ELECTRICITY SUPPLY.—The Town Council has decided to proceed with the laying of main transmission lines in connection with the West Midlands Electricity District at an estimated cost of £17,926, including boxes, transformers, temporary buildings, &c. The mains and equipment will be transferred to the Joint Authority.

Tramway and Railway Notes.

Aberdeen.—PURCHASE OF UNDERTAKING DECLINED.—In connection with the proposed purchase of the tramway undertaking of the Aberdeen Suburban Tramways Co., by the Town Council, the Tramways Committee decided at a recent meeting that no further action should be taken in the matter.

Bradford.—RAILLESS CARS.—The Tramways Committee is applying to the Ministry of Transport for sanction to the erection of overhead equipment in Brewery Street for the contemplated Lidget Green and Clayton railless-car service.

THROUGH-CAR SERVICES.—The Tramway Committee has decided to experiment on the Shelf and Bailiff Bridge routes with through-car services. The scheme will, it is expected, make it possible to put fewer cars on the long-distance routes and more cars on the short distance and more crowded routes, and if proved successful will be extended to other routes.

Canada.—NEW ELECTRIC RAILWAY.—According to *The Times*, the Ontario Hydro-Electric Commission is conferring with the municipalities concerned on a proposal to construct a high-speed radial railway from Toronto to Hamilton at a cost of $11,000,000.

Continental.—SWITZERLAND.—With the addition of a fifth unit at the Amsteg power station of the Swiss Federal Railway authorities the completion of the programme of construction covering the power requirements for railway electrification up to 1928 has been achieved, in so far as the Amsteg-Ritom group of generating stations is concerned. In order to fully utilise the Barberine reservoir, the erection of the power station at Chatelard is being followed by one at Vernayaz. The plant will include three 14,000-kVA generators. An interconnecting line operated at 130,000 V will link up the Amsteg-Ritom and the Barberine-Vernayaz systems.

BELGIUM.—The Société Nationale des Chemins de Fer Vicinaux, of Brussels, proposes to electrify an additional number of its lines in the province of Antwerp during the present year as well as to construct a number of new short electric railways, including one from the existing terminus at Hoogboom to the frontier at Putte. In the eastern part of the province the first line to be electrified will be that between Antwerp and Schilde. Plans are also being prepared for the electrification of the Antwerp-Malines and Boom-Pierre local railways.

Heywood.—NEW ROUTE.—According to the *Manchester Guardian*, it is proposed to construct a tramway connecting the municipal service at Hopwood and the Manchester Corporation tramway at Middleton.

India.—RAILWAY ELECTRIFICATION.—The electric train service of the Great Indian Peninsula Railway from the Victoria Terminus, Bombay, to Bandra, was inaugurated on February 3rd.

London.—UNDERGROUND JUNCTION COMPLETED.—According to *The Times*, a scheme which will have the effect of doubling the most important section of the Inner Circle was completed by the Metropolitan Railway on March 15th. A duplicate service of electric trains is thus provided for the first time over lines hitherto operated solely by steam trains. The Metropolitan Railway has been engaged for some months in constructing a junction to a point east of Euston Square, to link up a length of disused tunnel extending to King's Cross. It is now possible to switch over Metropolitan trains from the Inner Circle to the widened lines and thus secure an alternative route to Moorgate. The widened lines from King's Cross to Moorgate, over which the steam trains of the Great Northern section of the London and North-Eastern Railway and the Midland section trains of the London, Midland and Scottish Railway now run, have been electrified. Control of the junction of the new line with the existing Metropolitan track near Euston Square will be effected by means of electrical apparatus in a signal box at King's Cross, nearly 700 yards away. From this box also will be worked the junction points with the L. & N.E. and the L.M.S. Railways. With the opening of the new junction a number of through Metropolitan trains can be diverted over the widened lines to Moorgate. This enables the through trains to be expedited in both directions.

L.C.C. Tramcar Improvements.—The Highways Committee of the L.C.C. has recommended, with a view to eliminating the swaying motion of the four-wheeled type of tramcar, that 188 cars be equipped with an improved form of suspension gear at an estimated cost of £5,250.

Manchester.—Proposed Underground Railway.—The Manchester *Daily Dispatch* reports that it is expected that the report of the Underground Railway Committee of the City Council will be issued shortly. For the last two years this committee has been considering the city's traffic problem. It is not known at the moment what form the recommendations of the Underground Railway Committee will take, but it is expected that a scheme for linking up London Road, Central, Victoria, Exchange, and perhaps Oxford Road stations with an inner circle of electric underground lines, to form the nucleus of a bigger system, will be advanced. The first development of this will probably be extensions to Chorlton, Didsbury, Withington, and, on the other side, to North Manchester suburbs. The total cost of the scheme would be over £4,000,000.

Kent (Surrey).—Light Railway Inquiry.—According to the *Daily Mail*, proposals for a light railway 15 miles in length, to connect Orpington, near Chislehurst, Kent, with Sanderstead, near Croydon, Surrey, were outlined at a Ministry of Transport inquiry at Orpington recently. Col. H. M. Midder, for the promoters, said it was expected that the railway would develop the district as a residential suburb of London. The Southern Railway was willing to work the line and run electric trains from and to Charing Cross and London Bridge. Sir Herbert Walker, general manager of the Southern Railway, said that if an order were made and the promoters and the Southern Railway came to a satisfactory working agreement his directors would guarantee the interest on the debentures, £300,000. The capital would be about £300,000, and included in it was the cost of electrification, which was between £130,000 and £140,000. His board would find the capital for the electrification and take payment of it in shares, either preference or ordinary, as might be decided.

Telegraph and Telephone Notes.

Australia.—Naval Radio-Telegraphy.—With a view to improving the wireless communication services of the Royal Australian Navy, short-wave, continuous-wave apparatus is undergoing preliminary tests. A proposal that a strong naval communications reserve should also be formed is being considered. Though no definite action is likely to be taken for some time, it is likely, says the *Sydney Morning Herald* that the naval authorities will invite experienced amateurs who have pioneered short-wave work in Australia to join the naval wireless reserve.

Canada.—Marconi Operators' Strike.—The Marconi operators, through their Union Committee, have been assured of the continuance of the existing wage rate until April 1st, 1929. An agreement to this effect has been signed by the Marconi Company.—*Reuter* (Montreal).

Chile.—Telegraph Service.—The Chilean Government is reported by *Commerce Reports* to be interested in the purchase of the Commercial Telegraph Co.'s properties. That the report may be well founded is apparent from the fact that, at a meeting of the board of directors of the Commercial Telegraph Co. it was agreed to authorise an individual to enter into an *ad referendum* contract for the sale of the properties for $8,250,000 (paper). It is understood that the Government hopes to combine with the State telegraph service certain lines of the Commercial Telegraph Co. and in other places to avoid competition by these lines.

China.—Foreign Cable Dues.—With reference to the recent decision of the foreign Cable Companies not to accept any but Government telegrams dispatched from the administrations in the Yangtse Valley provinces, which may be handed over to the Companies by the Chinese Telegraph Administration in Shanghai, unless such messages were accompanied by cash, *Reuter's* correspondent is informed that the Chinese Telegraph Administration is now settling accounts half-monthly. So long as such settlements continue, telegrams will be forwarded in the usual way.

Empire Communication.—Press Union Resolutions.—A meeting of the Council of the Empire Press Union was held on March 12th to consider the resolutions adopted at the Imperial Press Conference held in Australia last autumn. Sir Robert Donald, chairman of the Council, presided, and he was supported by Lord Burnham, president of the Union. Regret was expressed at the delay in the erection in England of "beam" radio stations. Reference was also made, says *The Times*, to the Pacific Cable Board's intention to employ "loaded" cables in duplicating the Pacific channel, and the decision of the Western Union Telegraph Co. to lay a new "loaded" cable across the Atlantic; in view of the increased capacity afforded by "loaded" cables, it was decided that the Imperial Government be requested to take early steps to lay a new "loaded" cable across the Atlantic, and, in the meantime, to hire two channels from the Western Union Telegraph Co., so that full advantage might be taken of these new facilities. The motion to refer the resolutions to the Union's standing committee on cable and wireless communication was carried, and a special committee was appointed to watch the development of broadcasting and to co-operate with the standing committee.

Radio-Telegraphy.—West End Office.—A new telegraph office was opened on March 15th by Marconi's Wireless Telegraph Co., Ltd., at 20, Duke Street, Piccadilly, where telegrams may be handed in for transmission by high-speed wireless telegraphy to France, Spain, Austria, Switzerland, Canada, the United States, Bulgaria, Jugo-Slavia, and other parts of the world. The new office will conveniently serve the telegraphic requirements of the West End of London.

Switzerland.—Telephone Service.—The telephone service between Switzerland and France has been much improved this year, thanks to the opening of several new circuits. Since January no fewer than three new cables have been put at the disposal of Geneva, with a view of facilitating communication with the League of Nations, thus affording three wires for direct calls between Paris and Geneva. Berne, too, can now 'phone direct to Paris, except during certain hours, and for three weeks or so Zurich has had direct communication with Paris, much to the advantage of business men. As soon as the cable linking up Paris, Strasbourg, and Bâle is available to the public, further improvements in the Swiss service may be expected, and the new automatic 'phones are giving universal satisfaction. The public is being asked to criticise the present arrangements, and with but few exceptions little or no criticism is forthcoming.

The Telephone Service.—London-Germany Service.—A preliminary night telephone service was inaugurated on March 15th between London and Berlin, Hamburg, Bremen, Cologne, and Frankfurt. As the Continental sections of the lines to these towns are utilised for other purposes during the daytime, the service will be restricted to the hours 6 p.m. to 7 a.m. The charges for a three-minute call are considerably less than the normal day rates.

United States.—Telephone Timing.—A novel long-distance telephone economy has been adopted in the United States, where the canvassing of customers in distant parts by means of the telephone is now a recognised commercial practice. Salesmen of the H. J. Heinz Company, food manufacturers, use a small minute glass which they reverse as soon as telephonic contact with the client has been established. By this means they are able to regulate their calls so that full advantage is taken of every second, and the extra three-minute charge for a sentence or two is avoided. The glass is much more convenient and less distracting than the seconds hand of a watch. It costs only a few pence and saves many pounds a year.

Radio Notes.

Australia.—Licence Fees.—Since the inception of broadcasting in Australia about 18 months ago the amounts collected in licence fees are: New South Wales, £88,986; Victoria, £61,882; Queensland, £6,119; South Australia, £12,991; Western Australia, £8,960; Tasmania, £1,679.—*Reuter's Trade Service* (Melbourne).

Licences.—Number and Revenue.—Sir W. Mitchell-Thomson, Postmaster-General, in reply to a question in the House of Commons, said the total amount of fees for receiving licences collected up to the end of February, 1926, was approximately £2,147,000. The amount already paid to the British Broadcasting Co. was £1,114,000. The number of licences in force on February 28th last was approximately 1,906,000, as compared with 1,258,000 on February 28th, 1925.

Russia.—Manufacturing Output.—The radio sub-section of the Supreme Economic Council has had considerable difficulty in fixing the capacity of the Soviet market for wireless material owing to the absence of previous years' experience, but, after a study of the various branches and of the Western Europe and American markets, the value (according to present prices) of the output of radio articles in the Soviet Union is estimated as follows:—For the year 1925-26, 20,163,000 roubles; 1926-27, 29,732,000 roubles; 1927-28, 40,058,000 roubles; 1928-29, 53,115,000 roubles; and for 1929-30, 68,625,000 roubles. Owing to reduced costs of production, the amounts for 1926-27 are expected actually to be lower. In order to attain this output it will be necessary to extend the existing works, open the Nizhni Novgorod workshops as from 1926-27, and build a new works for the mass production of simple receiving sets to start activity in 1928-29.—*Reuter's Trade Service* (Moscow).

Wave-length.—Readjustment.—On March 11th, the following wave-length alterations were made at the instigation of the International Radiophony Bureau, Geneva, in order to avoid interference between stations:—

England.—Newcastle from 404 to 407 m., and Bournemouth from 386 to 387 m.

Austria.—Graz from 397 to 402 m.

Germany.—Breslau from 418 to 417 m.; Münster from 410 to 412 m.; and Hamburg from 395 to 392 m.

Irish Free State.—Dublin to 397 m.

The changes are not necessarily permanent, their retention depending on the working of the rearrangement.

Porcelain Insulator Manufacture.

Impressions of a Visit to Messrs. Taylor, Tunnicliff & Co.'s Staffordshire Factories.

(*Concluded from page* 384.)

IT will have been gathered from the first instalment of this article that, as compared with ordinary potting, the business of insulator-making is highly technical, necessitating the use of specially-prepared clays, special machinery, and most accurate workmanship; in fact, a large staff of skilled mechanics is kept constantly employed in constructing and renewing machinery, the size of the busy tool room being more suggestive of the engineering trade than of the ceramic industry. Testing facilities are, of course, an essential feature of such an organisation, for they afford the means of determining whether the potter's products have been rendered homogeneous throughout and thoroughly well vitrified in order that, apart from more mechanical strength, their electrical insulating properties may be depended upon under diverse climatic and other variable conditions, irrespective of the glaze.

Fig. 15.—A View of the Extra-high-pressure Testing Department.

In contrast to the transformer outfit (capable of furnishing a maximum pressure of only 60,000 volts) in use when we described the works 18 years ago,* the extra-high-voltage equipment installed at the Hanley factory now includes a 300-kVA, 300,000-volt, single-phase Ferranti transformer (figs. 15 and 16) fed from a 70-h.p. G.E.C. motor-generator that is capable of furnishing 150 kVA for short periods. A pure sine wave is obtained at frequencies of from 25 to 100 cycles per second. The G.E.C. control board is enclosed in a wire cage, the doors of which are interlocked with the oil switches for the protection of the operators. Some of the results obtained by the application of high electrical pressures are indicated by the accompanying reproduced photographs: Fig. 18 is a view of a 66,000-volt pin-type insulator flashing over dry at 165,000 volts; figs. 19 and 21 show 300,000-volt dry flashovers on a string of five 7-in. diameter suspension units, and the influence of arcing horns on the flashover path will be noted; fig. 20 shows a string of six similar units under artificial rain, the voltage in this case being about 200,000 volts.

Suitability of electrical design is gauged by dry and wet flash-over tests. In the latter case, samples are subjected to artificial rain equivalent to one inch in five minutes, directed downwards at an angle of 45 deg.; both the temperature of the water and its specific resistance are important factors. To determine the dielectric strength, insulators can be punctured under oil, and this test can be made, if necessary, at any temperature up to 100 deg. C., arrangements being available to heat the oil to this temperature and to heat the insulator previous to immersion; the oil tank used for this test can be seen in fig. 17. Other electrical equipment includes a high-frequency outfit (100,000 volts at from 50,000 to 200,000 cycles per second) of the oscillator pattern similar to a spark radio-telegraph transmitter. This outfit is illustrated in fig. 22, the motor-driven rotary spark-gap being visible on the right-hand side in front of the condenser box.

Fig. 23 shows porcelains for 10-in. suspension insulators undergoing a high-frequency test (80 kV), and it will be noted that the insulators are inverted in water, the reflection indicating how the discharge clings to the porcelain.

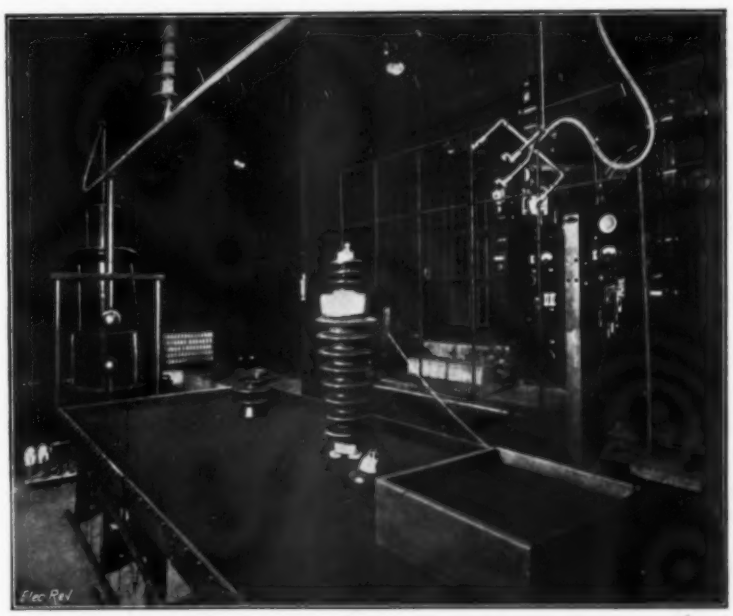


Fig. 16.—Testing Department, showing Switchboard and 300,000-V Transformer.

The current an insulator will allow to pass from the conductor to the earthed metal work under the influence of an alternating voltage is made up of the leakage (i) over the surface, (ii) through the body, and (iii) the capacity current through the porcelain dielectric. Nor-

* See ELEC. REV., March 6th, 1908, pp. 401 to 405.

mally, these currents are very small, but, since a spark is a conductor, they become excessive when a flash-over occurs. A well-designed porcelain insulator will always flash over without damaging itself and without puncturing. The chief factor governing the flash-over voltage and path is the distribution of the electric field and its relation to the contour of the insulator. When the insulator is correctly designed there is no appreciable formation of corona prior to flash over. In general, the best distribution results when the contour of the main "trunk" of the insulator conforms to one of the lines of force of the dielectric field, while the surface of the sheds follows the equipotential planes at right angles to the lines of force.

Other tests are also made to prove the suitability of the porcelain: One of them is known as the test for inherent stresses, and consists of immersing the insulator, or insulators, for one hour in water at 50 deg. C., followed by a similar period of immersion in ice and water, after which the dry flash-over test is applied. The insulator is only considered satisfactory if it can stand this test being repeated three times. It is important to know whether the porcelain shows any sign of porosity, and the test for this consists of immersing broken pieces in a 0.5 per cent. alcoholic solution of fuchsin dye under a pressure of 2,000 lb. per sq. in. for 24 hours; good porcelain shows no sign of penetration.

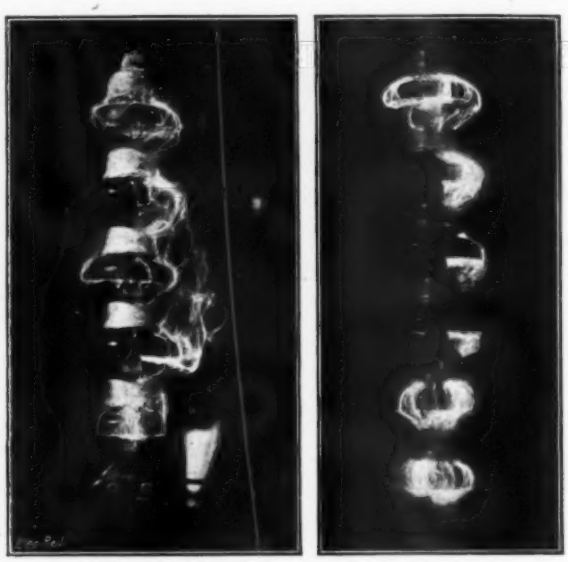


Fig. 19.—A 300-kV Dry Flash-over. Fig. 20.—A 200-kV Wet Flash-over.

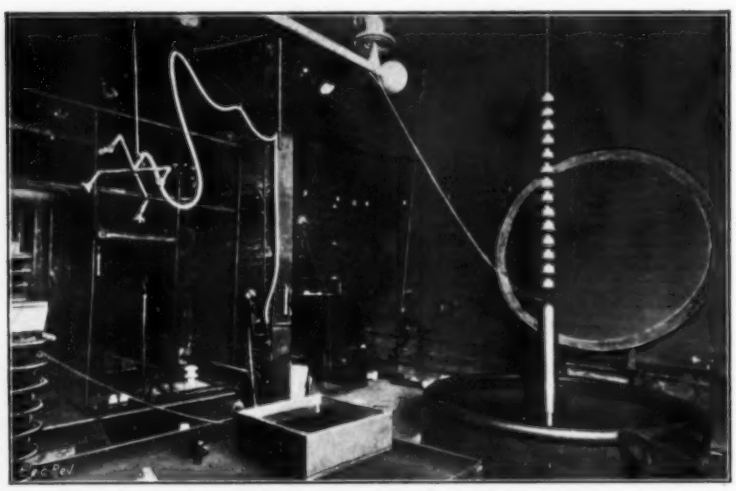


Fig. 17.—Oil Tank for Puncture Tests.

work, coal-fired Lancashire boilers are installed at all the factories, but before the steam is utilised for heating purposes it is passed through horizontal reciprocating engines which drive some of the machinery and vertical high-speed engines which drive d.c. generators for lighting and feeding motors in the works. At the Hanley works the power requirements are in excess of the steam demand, the difference being met by the use of town's gas engines. Thus it may be said that power and electricity are generated almost as by-products, but the subject is receiving attention at the moment, and it is probable that in the near future all the electricity needed will be purchased from the local municipal undertaking.

Although steam and electric power have been and are being utilised to a considerable extent, the first, and one of the most important, operations in the manufacture of an insulator dates back to one of the oldest, if not the oldest, handicrafts in the world, namely, the potter's wheel. English manufacturers

Fig. 18.—A 66-kV Pin-type Insulator Flashing Dry at 165 kV.

Fig. 21.—A 300-kV Dry Flash-over.

In conclusion, reference may be made to the works power supply. Steam being a necessity in the process

maintain that insulators made by this process are, without doubt, superior to the cheaper pattern, which is not "thrown" on the potter's wheel. The "thrower" uses no tools in making the insulator, he simply spins and forms the article entirely with his hands as he sits over his wheel, which manipulation is identical with that practised 50 centuries ago.

These facts, however, by no means imply that a long-established concern must necessarily be old-fashioned in its methods, for apart from the great improvements that have been made in the process work, labour-saving devices and machinery have been introduced with considerable advantage from the point of view of both workmanship and cost reduction.

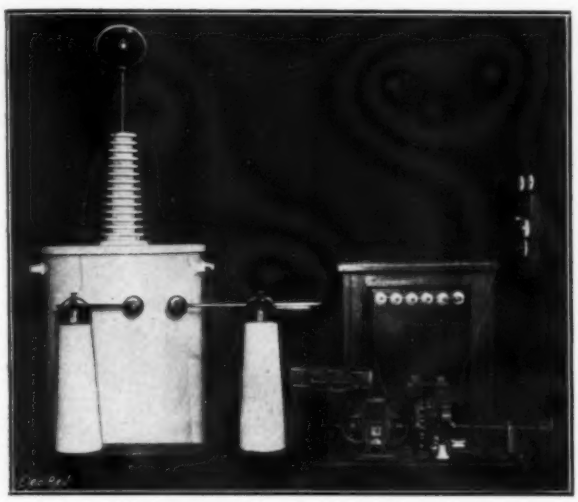


Fig. 22.—High-frequency Testing Outfit.

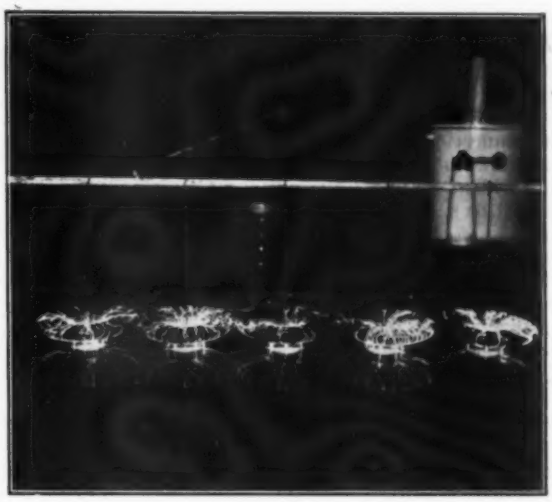


Fig. 23.—High-frequency Test at 80 kV.

We are indebted to the directors for the loan of some of the photographs reproduced in this article, and for the facilities placed at our disposal on the occasion of our visit to their factories.

The Flood-Lighting of Niagara Falls.

A particularly interesting and successful illumination scheme has recently been carried out at the waterfalls of Niagara. The project provides batteries of searchlights, placed in towers erected at the rear of the falls, which are arranged so as to flood-light the waters, resulting in the wonderful spectacular illumination illustrated in fig. 1.

Fig. 1.—Niagara Falls, Illuminated.

Fig. 2 shows one of the batteries, which consists of 24 36-in. medium-intensity searchlights. The lamps are of the horizontal d.c. arc type, and are equipped with silvered glass mirrors. Each has a single feed and an automatic magnetic control. The lamp working pressure is 45 volts, when the loading is 20 A. The lights are focused by means of a single lever and handle, the manipulating gear extending below the base of the searchlight. The rheostat is built up of resistance tubes, and is provided with an 8-way switch for adjusting the current taken by the lamp. The illumination in beam candle-power immediately in front of each light is 4,500,000 c.p. This should be distinguished from the measurement of open-arc illumination. The beam candle-power takes into account the character of the reflecting mirror, and the brilliancy of the crater in the positive carbon, as well as the quality of the glass in the front door, and is a direct measure of the effective illumination provided by the searchlight. It will be recalled that it was arranged when the scheme was first authorised that the Government, U.S.A., should pay one-third of the cost, $60,000, of installing the plant and maintaining it for the first year, the remainder to be borne by Niagara Falls, New York and Ontario, and the Government of Ontario.

Fig. 2.—Searchlight Battery.

Remote-Control Sub-Stations.

The New Tramway Sub-Stations at Croydon.

What are claimed to be the first two remote-control sub-stations to be used on tramway traction in this country have recently been put into commission at Croydon, one at Thornton Heath and the other at South Croydon, in connection with the through running of the L.C.C. tramcars to Croydon. The two installations are practically identical, both in equipment and operation, and it will be sufficient to describe only the one at Thornton Heath. A 3-phase, 50-cycle, 6,000/6,600-V supply is received from the Croydon generating station at Factory Lane, from where the sub-station is controlled, and is converted to d.c. at 560/575 volts, which is fed to a section of the tramway overhead system. The main equipment consists of the incoming e.h.p. switchgear, fig. 1, made by Messrs. Reyrolle, a British Electric transformer, a 500-kW, 600-V rotary converter of Messrs. Mather & Platt's manufacture, the necessary starting and regulating panel, which is equipped for the Shuttleworth-Thomas system of remote control, supplied by Messrs. Bertram Thomas, and a d.c. switchboard with Bertram-Thomas switchgear. In addition, a control panel is provided at the operating station. The Shuttleworth-Thomas remote-control system, which was originated by Mr. Shuttleworth, of the Hull electricity undertaking, employs a small number of pilot wires between the control and sub-stations. At the start the operator, by placing the controller handle in position, sends a small d.c. out from the generating station. It is received by a small motor situated at the foot of the starting panel, fig. 2, which, in a series of operations performed by a crank and connecting rod to which it is geared, operates the remote-control equipment. A 3-pole switch, short-circuiting the starting pony-motor, is first thrown into the open position, while the field rheostat of the converter, placed above the starting panel, is set to its starting position. A small multiple change-over switch is then operated and diverts the controlling energy to a motor on the e.h.p. switch panel. This closes the switch, and the supply, through the transformer, is connected to the pony motor. This is directly coupled to the converter, and

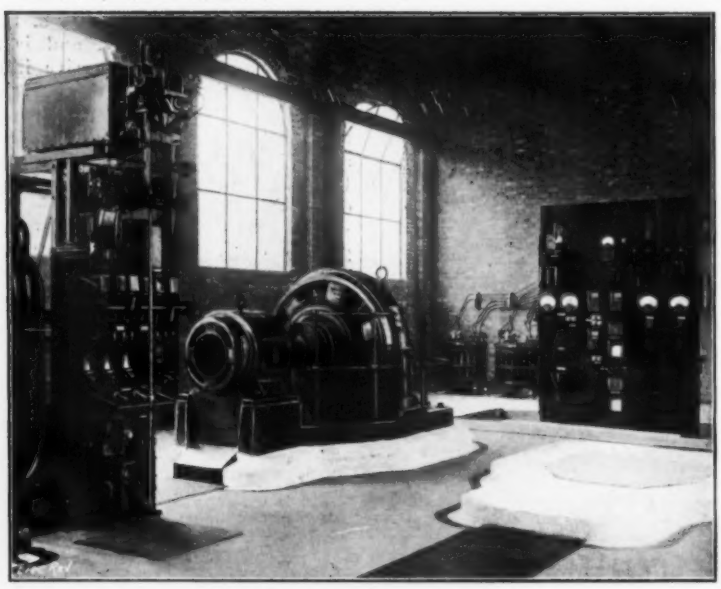


Fig. 2.—Remote-Control Sub-Station.

the machine starts and runs up to speed. The converter is self-synchronising by virtue of the very high starting torque of the motor and the reduction of the slip to a particularly low figure, which at the same time considerably increases the synchronising torque. The pony motor has a double winding and the same number of poles as the converter. The latter pulls quickly and quietly into step and remains steady until the normal operating pressure is reached, when the start-

Fig. 1.—E.h.p. Switchgear.

ing motor is cut out of circuit. The last operation is effected by the small motor on the control panel, to which the operating current is re-diverted after the operation of the e.h.p. switch. It now closes the machine switch, and the converter is ready for load. The multiple switch is again operated, this time diverting the pilot wires from the control panel to the d.c. side of the machine, and all further operations are controlled by the machine's own energy. The voltage regulation is effected by a system of relays at the top of the control panel. The relays are operated by the engineer at the main station by "tapping" a relay switch, each tap moving the rheostat one notch forward or backward as the case might be. When the pressure is correct the machine circuit breakers on the d.c. board are operated from the main station, and the machine is put on load. The d.c. switches can be operated from the main station, independently of the a.c. equipment, and the whole sub-station can be shut down immediately at any time. The installation was subjected to an interesting and somewhat drastic test on completion. A heavy feeder was run direct to the trolley wire just outside the station, and this was "shorted" to the rails; the machine stood the test and did not flash-over.

In conclusion, we are indebted to Mr. A. C. Cramb, M.I.E.E., for permission to inspect the installation, and to Mr. Eustace Thomas, of Messrs. Bertram Thomas, Ltd., for his assistance in the preparation of the above notes.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Argentina.—BUENOS AIRES.—April 12th. Public Works Department. Rock drilling installation, including steam shovel, aerial transporters, 170-h.p. electric generating plant, &c.*

May 3rd. Electric travelling crane, capacity 1½ metric tons.*

Department of Sanitary Works. May 26th. Two 1,000-kW Diesel-engine generating sets.*

May 27th. Electrically-driven centrifugal sewage pumps.*

Australia.—BRISBANE.—August 27th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator and two water-tube boilers, with economisers, draught plant, &c. Specifications (£5 5s.) from the offices of the company, Boundary Street, Brisbane.

MELBOURNE.—May 11th. P.M.G.'s Department. Telephone jacks.*

Barking.—April 20th. County of London Electric Supply Co., Ltd. Circulating-water pumps and pump-house equipment, circulating-water screening plant, and boiler-house and coal-handling plant. (See this issue.)

Barnes.—Electricity Department. E.h.p. and l.p. cables. (See this issue.)

Basingstoke.—April 6th. Electricity Department. One 600-b.h.p. heavy-oil engine and direct-coupled dynamo. (See this issue.)

Belfast.—April 3rd. Electricity Department. One 1,000-kW rotary converter, with transformer, l.p., a.c. switchgear, &c. (March 12th.)

Brazil.—RIO GRANDE DO SUL.—April 15th. Port and Bar Management. 10 electrically-operated portal cranes, capacity 2,500 kilos; 2 ditto, 5,000 kilos capacity; and 7 electric winches or capstans.*

Brentford.—March 30th. Board of Guardians. Wiring, &c., at the Institution, Warkworth House, Isleworth. (See this issue.)

Cardiff.—March 22nd. Electricity Department. Grit-collecting plant, 100-kW, 400-V alternator, &c. (March 5th.)

Colwyn Bay and Colwyn.—April 8th. Electricity Department. Stores for 12 months, including cables, joint boxes, cut-outs, house-service meters, &c. (See this issue.)

Edinburgh.—April 12th. Electricity Department. Four water-tube boilers, economisers, and mechanical stokers or alternatively, boilers, economisers, air heaters, and mechanical stokers, or boilers, economisers and powdered fuel plant. (March 12th.)

Egypt.—CAIRO.—April 27th. Egyptian Government. 1,100 desk telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1.

Erith.—March 27th. Electricity Department. 1,000 yd. (approx.) h.p. 3-core cable. (See this issue.)

Grimsby.—March 29th. Electricity Department. One 2,000-kW converter, one 1,000-kW ditto, l.p. switchgear, cable work, &c. (March 5th.)

Hallaton, Market Harborough.—Wiring and installation of electric lighting plant at Village Hall. (See this issue.)

Hazel Grove, near Stockport.—April 13th. Hazel Grove and Bramhall U.D.C. 2,300 yd. armoured cable. (See this issue.)

India.—March 30th. India Store Department. Complete equipment for one rotary-converter sub-station, three separate rotary-converter sets and track sectioning switchgear for the G.I.P. Railway electrification. (February 26th.)

March 24th. 30-line automatic and 10-line manual telephone equipment. (March 12th.)

April 19th. Goods lift for the Imperial Record Offices at Raisina, Delhi. (A.X .2,904.)*

April 2nd. Cable. (March 5th.)

April 23rd. Electrical equipment for 15 motor coaches and 42 trailer coaches. (March 5th.)

April 13th. 23 electric passenger locomotives. (February 26th.)

May 7th. 15 motor-coach underframes and bodies, 30 motor bogie trucks. (March 12th.)

Kettering.—March 23rd. Electricity Department. Transformers, e.h.p. and l.p. switchgear, one 1,500-kW rotary-converter equipment, and one steam turbo-boiler feed pump. (February 26th.)

Leyton.—April 9th. Education Committee. Installation of electric lighting and central heating at the Sybourn Street new school. (March 12th.)

London.—LONDON COUNTY COUNCIL.—March 23rd. Wiring and fittings for electric lighting at St. Paul's Road elementary school, Bow, E. (March 5th.)

METROPOLITAN ASYLUMS BOARD.—March 24th. Installation of electric lighting at the Southern (Lower) Hospital, Dartford. (March 5th.)

ISLINGTON.—March 29th. Borough Council. Two 3½-ton electric refuse-collecting vehicles fitted with steel tipping bodies (March 12th.)

Luxembourg.—The municipal authorities of Luxembourg have invited tenders for the supply of 2,300 metres of 700-V armoured cables.

Manchester. — March 22nd. Electricity Department. 3-phase, 420-V sub-station switchgear, 3-phase, 6,600-V and 11,000-V ditto, three 500-kVA static transformers, and one 7,500-kVA forced-air-cooled transformer. (February 19th.)

March 22nd. One 5-ton electric tipping wagon and one 10-ton electric tractor with trailer. (February 26th.)

April 6th. 3-phase, 6,600-V sub-station switchgear. (March 12th.)

March 26th. One 10-ton hand-operated overhead travelling crane and gantry, Blackley sub-station. Form of tender from Mr. H. C. Lamb, manager, Electricity Department, Town Hall.

March 23rd. Tramways Committee. Copper bonds for tramway rails. Forms of tender from Mr. Henry Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly.

PROVINCE OF EAST LANCASHIRE.—Wiring, &c., Masonic Temple, Manchester. (March 12th.)

Mountain Ash.—March 22nd. Electricity Department. Two 500-kVA transformers. (March 5th.)

New Zealand.—June 21st. Auckland Electric Power Board. L.p. insulators, &c.*

Otley.—March 30th. Wharfedale Isolation Hospital Committee. Electrical installation at the Isolation Hospital, Menston. (March 5th.)

Pentre, Rhondda.—March 27th. Rhondda U.D.C. Electricity Department. 12 months' supply of house-service a.c. ordinary and prepayment meters, cable, joint boxes, compound, cut-outs, &c. (March 5th.)

South Africa.—JOHANNESBURG.—April 12th. S.A. Railways and Harbours. Electrification of Cape Town Suburban Railway. Supply and erection of the overhead equipment of the permanent way and overhead transmission and distribution lines. (February 12th.)

May 6th. Two electric goods lifts.*

Stirling.—March 26th. Corporation. Electrical work at 38 houses. Specifications from Burgh Surveyor.

Sutton Coldfield.—March 24th. Electricity Department. E.h.p. underground mains, distributors, feeder pillars, and network fuse boxes. (March 5th.)

Walthamstow.—March 24th. Electricity Department. 12 months' supply of l.p. cables and v.i.r. wires. (March 12th.)

April 13th. Electricity Department. Steel overhead bunkers and boiler-house buildings; and coal- and ash-conveying plant. (March 12th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Andover.—Town Council. Accepted:—

Installation of electric pumping plant at the sewage pumping station.—Edwards & Armstrong, Ltd.

Australia.—Sydney City Council has decided to accept the Cockatoo Dockyard's tender of £666,000 for the construction of power-house plant on Cockatoo Island.—*Reuter* (Sydney).

Aylesbury.—Town Council. Accepted:—

H.p. transmission lines and services for the extended area of supply (£37,822).—Craven and District Electrical Construction Co., Ltd.

Bradford.—Baths Committee.

Installation of electric lighting apparatus at Lapage Street school baths.—F. Draycott.

Tramways Committee.

32½ tons of hand-brake shoes (£325); 45 tons of track-brake blocks (£446).—Cole, Marchent & Morley, Ltd.

6 miles of 4/0 round copper trolley wire (£584).—F. Smith & Co., Ltd.

Cardiff.—At a meeting of the City Council last week, the recommendation of the Electricity Committee to accept a Belgian tender for low-pressure cables was referred back.

Darlington.—Town Council. Accepted:—

Four additional trolley 'buses (£6,312).—Clough, Smith & Co.

East Ham.—Electricity Committee. Accepted:—

1,000-kW motor-converter (£4,044).—Bruce Peebles & Co., Ltd.

Switchgear (£173).—A. Reyrolle & Co., Ltd.

London.—WANDSWORTH.—L.C.C. Education Committee. Recommended:—

Electrical installation at Technical Institute:

F. C. Minton, Ltd. (Recommended.)	**£1,573**
Pinching & Walton	1,721
Malcolm & Allen, Ltd.	1,730
H. J. Cash & Co., Ltd.	1,752

The chief engineer's comparable estimate is £1,630.

CAMBERWELL.—Works Committee. Recommended:—

Maintenance of electric lighting, heating and power installations, &c., at public buildings.—Commercial Telephone & Electric Co., Ltd.

St. Pancras.—Electricity Committee. Switchgear for Grafton Road sub-station :—

British Thomson-Houston Co., Ltd. (Recommended.) ...	**£2,826**
English Electric Co., Ltd.	2,826
Metropolitan-Vickers Electrical Co., Ltd	3,008
Ditto (alternative)	3,166
Ferguson, Pailin, Ltd.	3,019
Reyrolle & Co.	3,050
Switchgear & Cowans, Ltd.	3,050
B. Thomas	3,050
General Electric Co., Ltd.	3,075
Whipp & Bourne, Ltd.	3,271
Johnson & Phillips, Ltd.	3,275
Park Royal Engineering Co., Ltd.	3,320
Ditto (alternative)	3,150
New Switchgear Construction Co., Ltd.	3,398

Shoreditch.—Electricity Committee. Accepted :—

Cable (£919).—W. T. Glover & Co., Ltd.

St. Marylebone.—Electricity Supply Committee. Recommended :—

Avery one-ton automatic hopper weigher (£904).—Babcock & Wilcox, Ltd.
Duplicate synchronising equipment (£78); earth resistance for e.h.p. supply (£198).—Ferguson, Pailin, Ltd.
Spare grab for the coal crane (£206).—W. Goodacre & Sons.

Ferrybridge (Yorks.).—Yorkshire Electric Power Co., Ltd. Accepted :—

Corrugated copper expansion pieces required in connection with the circulating water piping at the New Ferrybridge power station (£873).—Empress Coppersmiths & Engineers, Ltd.

Portsmouth.—Electric Lighting Committee. Accepted:

Steel-frame turbine house at the generating station, Gunwharf Road (£7,174).—Tanner Bros.
Electric travelling 60-ton crane (£2,442).—Royce, Ltd.

Preston.—Electricity Committee. Accepted:—

Supply and erection of towers and overhead transmission line (£38,456).—Callender's Cable & Construction Co., Ltd.

Swansea.—Health Committee. Accepted:—

Re-wiring Corporation stables (£72).—W. H. Norman Kirk.

Weymouth.—Electricity Committee. Accepted:—

Distributor cable (£212).—Johnson & Phillips, Ltd.
Two boilers of 20,000 lb. capacity each (£16,350); two 1,500-kW turbines and alternators (£13,520); two condensing plants (£3,866); two 500-kW rotary converters, with switchgear, &c. (£6,495); circulating system (£230).—English Electric Co., Ltd.

Forthcoming Events.

Institution of Engineering Inspection.—Friday, March 19th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper on "Lubricating and Allied Oils," by Mr. E. A. Evans.

British Electrical Development Association.—Friday, March 19th. At the Hotel Cecil, Strand, W.C. At 7 for 7.30 p.m. Annual dinner.

Manchester Electro-Harmonic Society.—Friday, March 19th. At the Albion Hotel, Piccadilly, Manchester. Monthly concert.

City & Guilds of London, Central & Finsbury Engineering Colleges Old Students' Associations (Northern Section).—Friday, March 19th. At the Engineers' Club, Manchester. Annual dinner.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, March 20th. At the South Wales Institute of Engineers, Park Place, Cardiff. At 6 p.m. Discussion on "The Control and Distribution of Electricity in Mines," by Mr. I. Jones.

Willesden Polytechnic Electrical Engineering Society.—Saturday, March 20th. At Reggiori's Restaurant, Chapel Street, Edgware Road, W. At 6.30 p.m. Annual dinner.

Electrical Trades Commercial Travellers' Association.—Saturday, March 20th. At the Manchester Hotel, Aldersgate Street, E.C. At 7.30 p.m. Grand carnival dance.

Electrical Power Engineers' Association (London Western Section).—Saturday, March 20th. At Stewart's Restaurant, Victoria Street, S.W. At 7 p.m. Annual dinner.

(Kent Section).—Saturday, March 20th. At Hollingworth Hall Church Institute, Maidstone. At 6 p.m. Lecture on the "Brush-Ljungström Steam Turbine," by Mr. J. R. Hutchings.

Royal Society of Arts.—Monday, March 22nd. At John Street, Adelphi, W.C. At 8 p.m. Cantor Lecture on "Thermometry," by Mr. W. F. Higgins (Lecture II).

Institution of Electrical Engineers.—Informal Meeting.—Monday, March 22nd. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Performance of Mercury Arc Rectifiers," to be opened by Mr. G. Rogers.

(North-Eastern Centre).—Monday, March 22nd. At the Armstrong College, Newcastle-on-Tyne. At 7 p.m. Paper on "Developments in High-power Fuses," by Mr. L. C. Grant.

(North Midland Centre).—Tuesday, March 23rd. At the Yorkshire Cinema Exchange, Queen's Arcade, Leeds. At 7 p.m. Paper, "Some Notes on the Installation of a Modern Power Unit," by Mr. J. W. J. Townley.

(East Midland Sub-Centre).—Tuesday, March 23rd. At the University College, Nottingham. At 6.45 p.m. Paper on "Power Factor," by Messrs. C. C. Sutton and J. H. R. Nixon.

(North-Western Students' Section).—Tuesday, March 23rd. At Milton Hall, Deansgate, Manchester. At 7.30 p.m. Ordinary meeting.

Royal Institution.—Tuesday, March 23rd. At 21, Albemarle Street, W.1. At 5.15 p.m. Lecture on "The Growth of Crystals," by Prof. C. H. Desch.
Friday, March 26th. At 9 p.m. Lecture on "The Radiation from Atomic Nuclei," by Sir Ernest Rutherford.
Saturday, March 27th. At 3 p.m. Lecture on "The Rare Gases of the Atmosphere," by Sir Ernest Rutherford.

Radio Society of Great Britain.—Wednesday, March 24th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Lecture on "Fading," by Prof. E. W. Marchant.

Institution of Production Engineers.—Wednesday, March 24th. At 83, Pall Mall, S.W. At 7.30 p.m. Paper on "Works System," by Mr. J. T. Kenworthy.

Institution of Welding Engineers.—Thursday, March 25th. At Caxton Hall, S.W. At 8 p.m. Paper on "Electric Welded Construction," by Mr. J. Caldwell.

British Electrical Development Association Conference.—Friday, March 26th. At Caxton Hall, Westminster, S.W. At 9.30 p.m. Paper on "Progress and Prospects of Commercial Electric Cookery," by Mr. J. J. McKenna.

Birmingham Electric Club.—Friday, March 26th. At the Grand Hotel, Birmingham. At 7 p.m. Lecture on "Telephone Repeaters."

Physical Society of London.—Friday, March 26th. At the Imperial College of Science, South Kensington. At 5 p.m. Ordinary meeting.

National Association of Supervising Electricians.—Saturday, March 27th. At the Holborn Restaurant. Annual dinner.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

Excellite insulating board.
Fortifix quick drying cement.
Small galvanic machines operated by the insertion of a coin.
Omni-Volt electric irons.

Notes.

Smoke Abatement Recommendations.—In a topical talk on "The Smokeless Age" from the London station of the British Broadcasting Company on March 9th, Dr. J. S. Owens, M.D., A.M.Inst.C.E., hon. secretary of the Advisory Committee on Atmospheric Pollution, outlined the recommendations contained in the final report of Lord Newton's Smoke Abatement Committee, on which, he said, the Smoke Abatement Bill to be introduced into Parliament shortly by Mr. Neville Chamberlain, Minister of Health, might probably be constructed. The Committee suggested a general tightening up of all existing smoke-prevention laws, and the placing of a legal obligation on all manufacturers and users of engines or plant of any description to adopt the best practicable means of avoiding the pollution of the air by smoke; also certain changes in the administration of the law, under which smoke-makers would be punished by much heavier penalties than those in vogue at present. In dealing with domestic and kitchen smoke, it was recommended that every encouragement should be given to the cheapening of the supply of gas and electricity, while municipal authorities should not make profits out of their gas and electricity undertakings in order to relieve the rates. The Committee also proposed that the Central Housing Authority should decline to sanction any housing scheme unless the plans provided for the adoption of smokeless methods of heating and cooking.

Artificial Sunlight Exhibition.—An exhibition of artificial sunlight apparatus was held at the Middlesex Hospital, London, from March 11th to 16th, when an excellent display was seen. We are unable to deal with the matter in this issue owing to pressure upon our space.

Fatality.—While operating a coal-cutting machine at the No. 2 Pit, Hucknall, last week, a collier named Arthur Allsopp, was killed owing to the breaking of the connecting cable.

Late Legal.—Armorduct Cable Co., Ltd.—In the Chancery Division on March 16th, Mr. Justice Eve confirmed a reduction of capital of Armorduct Cable Co., Ltd., by cancelling 18s. on each ordinary £1 share and cancelling the deferred shares altogether. Mr. Gedge, for the company, explained that between £7,000 and £8,000 of the loss was upon trading.

The New Electricity Board.—Tuesday's edition of the *Financial Times* contains an article embodying the views of a leading municipal engineer in London, of Col. Morcom and Mr. D. N. Dunlop, of the B.E.A.M.A., and Mr. M. J. Railing, of the General Electric Co., Ltd., regarding the provisions contained in the Electricity Bill with reference to the constitution and authority of the proposed Central Electricity Board. In the main these all express dissatisfaction with the proposed constitution. A powerful industrial executive was expected from the speech delivered by Mr. Baldwin at Birmingham, whereas the idea conveyed in the Bill is that there will be what is tantamount to a second group of Electricity Commissioners under the domination of the existing Commission.

Speaking at the Royal Colonial Institute luncheon at the Cannon Street Hotel, London, on March 16th, when Mr. J. Sandeman Allen, M.P., presided over some 70 members and guests, Sir Philip Dawson, M.P., said the subject was of national importance, and he had given it much attention. The consumption of electricity per head of population in this country was between one-fifth and one-sixth of that in other countries; in London it was just half the Berlin figure. From a given size of station the output in Germany was twice what it was in this country. In England they suffered from an excess of inefficient stations, and what that meant was obvious from the coal consumption and heat efficiency figures. In most stations there was also an excess of spare plant; for instance, assuming the maximum demand to be 100,000 h.p., the station should contain 25,000-h.p. generating sets with two sets (or 15 per cent.) as spare plant; one set being available in case of breakdown, while the other was being overhauled. To-day, however, between 60 and 70 per cent. of the total plant installed in this country was spare. The remedy for that state of affairs was not new; it was in use in America and in Europe, and was the interconnection of the principal stations. Why was legislation necessary to carry such a scheme through? Simply because common-sense was the most uncommon sense, jealousy between undertakings preventing them from co-operating. Private undertakings, such as collieries and steel works, were prepared to supply their

excess power into the public network as was being done on the North-East Coast, where nearly a quarter of the total supply was furnished by waste heat. His recent investigation in Germany also showed that a great deal could be done with waste heat. There surplus blast-furnace and other gases were either converted into electricity or supplied direct as gas into the public mains. Water power would also be of assistance, and, although it might be surprising to some, there was quite a number of fair-sized water powers available in this country.

Regarding the criticism that transmission losses and transmission-line costs would be too heavy to make such a scheme worth while, it should be remembered that the saving in spare plant would more than pay for such lines, and at the voltages that were now being used (from 100,000 to 200,000 volts), the line conductors could be very small. Although he believed that an Electricity Bill was essential, it did not mean that power would be available to the general public at ½d. per kWh; that was impossible, except in the case of certain chemical works which carried on continuous processes. Nevertheless, a Bill would materially improve present conditions.

After quoting an article in a German newspaper to indicate the interest which our principal rivals were taking in the measure, he approved of the idea of the Bill, which he characterised as sound, both technically and economically. He had the greatest admiration for the Electricity Commissioners, and was certain that they had the interest of the industry at heart, but the consumer and prospective consumer should be considered before the producer and manufacturer. Whilst it was desirable to preserve the freedom of private enterprise, the supply of electricity was a public utility service and, as such, must be under public control. The only criticism he had to offer was in that connection: The present intention was to make the National Central Board the servant of the Commissioners; that was totally wrong. The Commissioners should be no more than advisers to the Board, and unless the Board were composed of business men, totally independent of all political influence, it might do harm. If any appeal against the decision of the Board were necessary (and he thought there would be very few appeals) it should be to Cæsar—in this case the House of Commons.

E.A.W. Activities.—A meeting is to be held in the Lord Mayor's Parlour, Town Hall, Manchester, on March 25th, at 3.15 p.m., to inaugurate the Manchester District Branch of the Electrical Association for Women. Tea will be provided at 4 p.m., by the courtesy of the Manchester Corporation Electricity Department. The work of the branch will be outlined by the director, and the local officers and Council will be formally elected at the meeting. Miss G. L. Entwisle, A.M.I.E.E., is acting as hon. secretary. Lady Brooks, Mr. R. A. Chattock, and the Director will address a public meeting under the auspices of the Birmingham branch on March 29th, in the Council Chamber, Birmingham.

Association of Special Libraries and Information Bureaux.—A business meeting at which it is proposed formally to inaugurate the Association of Special Libraries and Information Bureaux will be held at the Institution of Mechanical Engineers, Storey's Gate, London, at 2.30 p.m. on Monday, March 29th, 1926. All who are interested are invited to attend. The Association is being formed to facilitate the co-ordination and systematic use of sources of information in science, industry, commerce, and public affairs generally; when fully developed it will function as a clearing house for those wishing to get into touch with specialised knowledge. The Association's first activity is to be the compilation of a Directory of Special Libraries and Information Bureaux in the British Isles. The Carnegie United Kingdom Trustees, in addition to setting aside the sum of £1,500 to assist the Association in the first two years of its work, have generously undertaken to defray the cost of compiling the Directory. Those willing to collaborate with the Association in building up the Directory are asked to communicate with the organising secretary (38, Bloomsbury Square, W.C.1), from whom further information may be obtained.

Liverpool Engineering Society.—It is interesting to note that this Society attained its jubilee in November of last year, having been founded by six pupils of Mr. G. F. Lyster, engineer-in-chief to the Mersey Docks and Harbour Board, in November, 1875. In a paper read on March 3rd, Mr. W. E. Mills reviewed the history of the Society from its commencement; the author himself has been associated with it for 46 years, and was president in 1885. Many distinguished engineers have occupied the presidential chair or have been members of the Society, which last year had a roll of 866 members.

International Congress of Engineers' Councils.—The third International Congress of Engineers' Councils will meet at Warsaw on May 13th.—*Reuter* (Warsaw).

Research in France.—At the last meeting of the French Union des Syndicats de l'Electricité it was reported that the Wire and Cable Committee was engaged on a consideration of the question of tension and bending tests for rubber-insulated cable. The Transformer-Oil Committee has also drawn up a draft scheme of the research work to be entrusted to the Ecole Supérieure du Petrole, in Paris, which, thanks to subscriptions which have been received, can be put in hand at once.

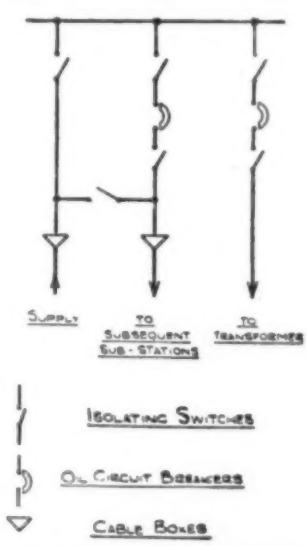
A series of new regulations for the installation, starting, and dismantling of transformers has lately been drawn up by the French Chambre Syndicate des Constructeurs de Gros Matériel Electrique.

A Peculiar Explosion of an Electric Boiler.—Some time ago a case occurred in Canada of an electric boiler exploding, wrecking the house in which it was installed. Difficulty was experienced in tracing the cause of the explosion, but as the result of investigations carried out by Prof. J. W. Shipley and Mr. A. Blackie it has been established that gases of an inflammable and explosive nature can be generated electrolytically in electric water heaters, and the explosion was probably due to this cause. The experiments carried out established without doubt (according to the Canadian *Electrical News*, which publishes a description of the tests) that single-phase, 60-cycle alternating current at either 110 or 220 V will generate gases in aqueous electrolytes, and that these gases are generally of an explosive nature. One typical analysis gave the following results:—Carbon dioxide 10.4 per cent.; oxygen 1.4 per cent.; hydrogen 49.8 per cent.; and nitrogen 38.4 per cent. This mixture was found to be inflammable, and when mixed with 70 per cent. of air was explosive. It is apparent from the composition of the gases generated that their nature depends upon the composition of the electrodes used in the experiments. The metals evolved very little, if any, hydrocarbon gases, while the carbon electrodes gave a considerable percentage of these gases. It was found that the rate of evolution of gas depended upon the spacing of the electrodes, the relation of the electrodes to the shell, the current flowing, the temperature of the electrolyte, and the depth of immersion of the electrodes. The composition of the gas was also found to be a function of the manner of operation of the system; that is, the surge between the electrode chamber, the radiating system and the expansion tank.

In suggesting means for safeguarding against explosions of gases in electric boilers, the investigators consider that it is risky to rely upon the automatic venting of the chamber gases, and all installations of such water heaters should be provided with a water-gauge glass whereby the accumulation of gases retained within the electrode chamber could easily be detected.

A New Element.—It has been announced by the University of Illinois that Dr. B. S. Hopkins, Professor of Inorganic Chemistry, claims, with his assistants, to have isolated from rare earths one of the five elements whose places in the scale of atomic numbers have not, up to the present, been filled. Its place is the 61st in the scale, says *The Times*, the discovery being the result of more than five years of research with special X-ray apparatus.

Simple Sub-station Protection. — The accompanying illustration shows the arrangement of the high-pressure system in each of the sub-stations of the Morecambe Corporation which deal with a 6,600-V, 3-phase bulk supply from the Lancaster Corporation. It will be noticed that the high-



Method of Sub-station Protection.

pressure incoming feeder to each sub-station is taken to the bus-bars merely through a set of isolating switches, the protection for this feeder being at the outgoing end of the previous sub-station. An arrangement of links is provided so that the whole of the high-pressure gear in each sub-station can be isolated for cleaning purposes. The supply is maintained by closing a set of isolating switches which short-circuit the sub-station, as shown on the diagram. The sub-station equipments were supplied by the General Electric Co., Ltd.

The British Association.—The 1927 meeting is to be held at Leeds, and Sir Arthur Keith, Hunterian Professor in the Royal College of Surgeons, is being nominated for the presidency.

An All-Electric Hotel Kitchen.—An interesting all-electric domestic installation, representing 100 kW of total connected load, is to be found at the Greyhound Hotel, High Street, Croydon, where the kitchen has recently been equipped entirely with electrical cooking apparatus. The installation consists of a 24-kW boiling table, made up of twelve double-section plates of equal loadings; one medium-size boiling table of 16-kW loading, comprising eight 2-kW plates; one large double-oven roasting range of 10-kW loading for each oven; and a fish fryer. The last-mentioned apparatus has two pans, each of 6-9-kW capacity. Two bains-marie, of 6.5-kW loading each, are also installed, and a two-compartment, 7.2-kW grill and a ten-gallon, 6-kW stock pot complete the installation. Although it is at present too early to obtain any useful consumption figures, we understand that the hotel

An All-Electric Hotel Kitchen.

management is well satisfied with the results obtained so far. The following figures give the approximate number of meals dealt with weekly by the equipment at present, but these by no means represent the full capacity of the apparatus:—Luncheons and suppers, from 1,000 to 1,500; dinners, from 500 to 700; and staff meals from 500 to 700. The whole of the apparatus was supplied by the Jackson Electric Stove Co., Ltd.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETING.—At the informal meeting on Monday, March 8th, Mr. M. Whitgift was in the chair, when Mr. F. Creedy opened a discussion on "A Recent Development in A.C. Apparatus." The title of the paper did not convey the full significance of the subject, for Mr. Creedy for the first time made public a new type of rotary converter that he has designed, which may have quite notable results. He called it a "Binary Converter" because it combined the two principles of d.c. and induction in one machine. It consists of a stator with a shunt winding and an a.c. basket winding. The armature tapped at three equidistant points forms a short-circuited wound rotor which is rotated by the a.c. winding operating in a d.c. field. The rotor has a commutator and delivers direct current. The ingenious design eliminates induction in the d.c. field coils by having the length of the a.c. pole pitch double that of the d.c. The machine has only been made in small sizes at present, but for the range of ½ kW to 5 kW remarkably good efficiency is claimed. It has been installed for lift work, and it may be made with the drooping characteristic of welding generators. It may be connected without a transformer to any voltage up to 6,000 V to deliver d.c. at any voltage possible to the commutator. A lively discussion followed.

STUDENTS' LECTURE.—A lecture and demonstration on "The Art of Illumination" is to be held at the Lighting Service Bureau, Electric Lamp Manufacturers' Association, 15, Savoy Street, W.C.2, for Student members of the I.E.E., on April 28th, at 7 p.m. The demonstration will be preceded by a free tea at 6.30 p.m., and each member may invite one friend. Early application for tickets should be made to Mr. J. W. Moffatt, hon. assistant secretary, 21, Lanier Road, Lewisham, S.E.13.

Institution of Civil Engineers.—ANNUAL DINNER.—At the annual dinner of the Institution on March 10th, the Prince of Wales was the principal guest, and proposed the toast of "The Institution," of which he is an honorary member. In the course of his remarks, the Prince referred to the great achievements of British engineers which he had seen in all parts of the world, and recalled the occasion, three years ago, when he opened the capital power station at Rotherham. This station was named after him, and has maintained a high record for efficiency.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Mr. CHARLES WHILLIS, M.I.E.E., who for the last five years has been in charge of the Technical Section of the Northern District Superintending Engineer's office and was formerly in charge of the Newcastle South and Carlisle Sections, left Newcastle on March 10th to take charge of an important branch of the Engineer-in-Chief's Office, G.P.O., London. Mr. Whillis's departure took place at short notice, but a large number of members of the staff of the Northern District Engineering Department met in the superintending engineer's office to bid him good-bye and to present him with a bureau of the Chippendale period. The chair was taken by Mr. J. R. M. Elliott, M.I.E.E., superintending engineer of the Northern District. Mr. Elliott recalled the changes which had taken place since Mr. Whillis entered the P.O. service over 30 years ago. Messrs. Baldwin, Andrews, Motyer and Cook expressed the congratulations of the staff. Mr. Baldwin called attention to the fact that Mr Whillis was the second officer from the Northern District who, within the last three months, had been called to take up an important position on the headquarters' staff.

The St. Pancras Electricity Committee recommends granting three months' leave of absence to Mr. BAYNES, the chief electrical engineer, upon medical advice.

M. JAN SRAMEK has recently been appointed the Minister of Posts and Telegraphs for Czecho-Slovakia in place of Dr. E. Franke, who has resigned.

Mr. W. T. HODGSON, electrical engineer, Horsell, has been elected a member of the Woking Urban Council.

The Derby Town Council has increased the salary of its electrical engineer, Mr. T. P. WILMSHURST, from £1,250 to £1,400 per annum.

In view of the growth of the undertaking, the Douglas (Isle of Man) Corporation Electricity Committee recommends increasing the salary of Mr. BERTRAM KELLY, the electrical engineer, from £500 to £550.

Mr. J. CONRAD FULLER, A.M.I.E.E., of the Posts and Telegraphs Departments of the Federated Malay States, has arrived in London on long leave. He is staying at the Engineers' Club, Coventry Street, W.1.

Mr. J. W. LONGLEY, a consulting civil and electrical engineer and chairman of the Bradford Corporation Electricity Committee, was on March 8th unanimously elected to the aldermanic bench to fill a vacancy created by a recent resignation.

Senatore MARCONI is reported to be making a good recovery from an operation for internal trouble which he underwent in a London nursing home last week.

Mr. WILLIAM HAINSWORTH, commercial assistant in the Stoke-on-Trent Electricity Department, who is leaving to take up a similar position with the Croydon Municipal Electricity Department, has been presented by his colleagues with a silver cigarette case.

Mr. JOSEPH A. FORDE, electrical engineer, has been re-elected, unopposed, a member of the Broadstairs Urban Council.

St. Marylebone Electricity Supply Committee recommends that the salary of Mr. C. H. SMYTH (chief electrical engineer), be increased from £1,500 (inclusive) to £1,700 (inclusive) per annum; that the salary of Mr. F. B. LEONARD (chief assistant engineer) be increased from £900 (inclusive) to £1,000 (inclusive) per annum; and that the salary of Mr. F. SELLEY (mains and sales engineer) be increased from £750 (inclusive) to £850 (inclusive) per annum, all as from April 1st, 1926.

Mr. A. BAXENDALE, depôt superintendent, Rawtenstall Corporation Tramways and Motor Bus Department, has been appointed rolling stock and works superintendent to the Wallasey Corporation Tramways. Mr. Baxendale has been eight years at Rawtenstall, and previous to this, was at Bolton Corporation Tramways.

Obituary.—MR. W. R. COOPER.—It is with feelings of very deep regret that we learn of the death, which occurred on Monday last at his residence in Tulse Hill, of Mr. William Ranson Cooper, M.A., B.Sc., M.I.E.E., A.M.Inst.C.E., consulting electrical engineer and electrochemist, of Westminster. Mr. Cooper was under the late Prof. W. E. Ayrton at the Central Technical College for three years, after which he was at the Richmond electric supply station. Later he was with Messrs. Latimer Clark, Muirhead & Co., and after a year in the Chemical Department at King's College he joined the staff of Mr. James Swinburne, subsequently becoming a partner in the firm of Swinburne, Cooper & Baillie, consulting engineers. For thirteen years he was editor of the *Electrician*. He was also editor for three years of *Science Abstracts*. Mr. Cooper had served on the Council of the Institution of Electrical Engineers, was a vice-president of the Faraday Society, honorary treasurer of the Physical Society, a member of the Electro-Culture Committee of the Board of Agriculture, and of the Conjoint Board of Scientific Societies. He was the author of numerous books, papers, and contributions to the Press, and was regarded as an authority on the subject of primary cells. If we may pay a personal tribute it shall be that we invariably found him a most courteous and amiable colleague. He had been in failing health for some time past, and the end came somewhat suddenly after a seizure. He was 58 years of age.

New Companies Registered.

Eirco, Ltd. (N.I.309).—Private company. Registered in Belfast on February 23rd. Capital, £5,000 in £1 shares. Objects:—To acquire the business of electrical engineers carried on by L. Scop, W. Coulson, and F. A. Newell as the "Electrical Installation and Repairing Co." The directors are:—L. Scop, A.M.I.E.E., 37, Gandore Avenue, Belfast, electrical engineer; W. Coulson, 535, Oldpark Road, Belfast, electrical engineer; F. A. Newell, B.Sc., Templepatrick, Co. Antrim, electrical engineer. Qualification, 100 shares. Registered office: 40, Berry Street, Belfast.

West Insulating Co., Ltd. (212,261).—Private company. Registered March 8th. Capital, £1,500 in £100 shares. Objects: To adopt an agreement between J. Borer and J. R. West, and to carry on the business of agents, brokers, importers and exporters, shippers and manufacturers of or dealers in electrical and mechanical materials, &c. The first directors are:—J. Borer, Bretonbac, Switzerland (president of the Fabrique Suisse d'Isolants, Bretonbac); J. R. West, 45, Brondesbury Villas, Kilburn, N.W.6. The directors for the time being of the Fabrique d'Isolants, Bretonbac, Switzerland, may appoint one director. Qualification (except such nominee), 500 shares. Secretary: E. G. Misani. Solicitors: Castle & Co., 31, Gracechurch Street, E.C.3. Registered office: 31, Gracechurch Street, E.C.3.

H. E. Messmer, Ltd. (212,287).—Private company. Registered March 10th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers' agents, dealers in machinery, scientific and electrical apparatus and instruments, testing apparatus, electrical, power and lighting installations, metal, paper, wood, rubber, glass, textile goods, parts, fittings, &c. The first directors are:—H. E. Messmer, 18, Arthur Street, New Oxford Street, W.C.2, manufacturers' agent (permanent managing director); and Mrs. Alice Messmer, 18, Arthur Street, New Oxford Street, W.C.2. Qualification, 1 share. Solicitors: Dalston, Sons & Elliman, 21, Southampton Street, Bloomsbury, W.C.1. Registered office: 18, Arthur Street, New Oxford Street, W.C.2.

H. D. Douglas & Co., Ltd. (212,323).—Private company. Registered March 11th. Capital, £1,000 in £1 shares. Objects: To carry on business as electrical, mechanical and general engineers, manufacturers, importers and exporters of and dealers in machinery, machine tools, implements and electrical, mechanical and scientific apparatus and accessories, manufacturers of and dealers in electrical insulation fabrics and tapes, oiled silks, linens, cottons and other fabrics, rubber-proofed fabrics, &c. The subscribers (each with one share) are:—H. D. Douglas, 42, Bromley Road, Catford, S.E.6, engineer; and H. C. Rose, 67, Hervey Road, Blackheath, S.E.3, merchant. Solicitors: Frank Simmons & Carter, 98, Salisbury House, London Wall, E.C.2.

West Wales Electric, Ltd. (212,310).—Private company. Registered March 10th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, motor, gas, mechanical, wireless, structural, heating, lighting and general engineers and inventors, constructors and installers of transmission systems, garage proprietors, manufacturing opticians, makers of scientific instruments, &c. The subscribers (each with one share) are:—L. G. Walker, Carregfelen, Portmadoc, electrical engineer; J. N. More, Crown Lodge, Harlech, surveyor; and A. Stokes, Portmadoc, solicitor. L. G. Walker is the first permanent director. Qualification, £50. Remuneration, not more than £50 each per annum. Secretary: L. I. Morgan. Solicitors: Breese, Jones & Cassen, Portmadoc.

Peerless Electrical Manufacturing Co., Ltd. (212,353).—Private company. Registered March 12th. Capital, £10,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical or mechanical or other kitchen and household equipment, food preparing machinery and labour-saving devices, including refrigerating and ice-making machines, ice cream freezers, potato peelers, mincing machines, cake and other food mixers, breaking, making and sausage machines, &c. The first directors are:—F. H. Wright, 1, Golders Green Crescent, N.W.11; and E. Shrubsole, 47a, Regent's Park Road, N.W.1. Qualification, 100 shares. Solicitors: T. V. Howells, 3, Rathbone Place, W.1. Registered office: 167 and 169, Great Portland Street, W.1.

Radioland, Ltd. (212,365).—Private company. Registered March 12th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, electrical and mechanical engineers, manufacturers of and dealers in apparatus, appliances and material relating to or used in connection with radio, or other telegraphy and telephony, gramophones and all kinds of talking machines, &c., to acquire the trade mark "Radiolys." The subscribers (each with one share) are:—E. S. M. Perowne, 7, Great James Street, Bedford Row, W.C., solicitor; F. G. Buckland, 49, Lavender Avenue, Mitcham, clerk; and G. F. Heard, 23, Harewood Road, Colliers Wood, S.W.19, managing clerk. The first directors are to be appointed by the subscribers. Solicitors: Perowne & Co., 7, Great James Street, W.C.1.

Barnes Brothers (Radiex), Ltd. (212,345).—Private company. Registered March 12th. Capital, £3,000 in £1 shares (1,500 10 per cent. preference and 1,500 ordinary). Objects: To acquire the business of scientific instrument manufacturers carried on by P. J. Barnes and F. S. Barnes, trading as Barnes Brothers, at Radiex House, Heygate Avenue, Southend-on-Sea, and to carry on this and the business of radio and general electrical and mechanical engineers, &c. The first directors are:—P. J. Barnes, 10, Boedell Avenue, Westcliff-on-Sea, Essex; and F. S. Barnes, "Trenholme," Thorpe Hall Avenue, Thorpe Bay. Qualification, 50 shares. Secretary: F. S. Barnes. Solicitor: H. B. Snow, 51, High Street, Southend-on-Sea. Registered office: "Radiex" House, Heygate Avenue, Southend-on-Sea, Essex.

Silgolum, Ltd. (212,335).—Private company. Registered March 11th. Capital, £500 in £1 shares. Objects: To acquire the trade mark "Silgolum," to adopt an agreement with R. Wellesley, and to carry on the business of electrical, hydraulic and mechanical engineers and contractors, producers and suppliers of electrical energy, manufacturers of machinery, &c. The first directors are:—C. R. Watson, 8, Sherwood Road, Wimbledon, S.W.19, accountant (permanent chairman), and H. C. Wright, 9, Mincing Lane, E.C.3, incorporated accountant. Qualification, £10. Remuneration as fixed by the company. Secretary: H. C. Wright. Registered office: 9, Mincing Lane, E.C.3.

Official Returns of Electrical Companies.

Robert Crust, Ltd. (184,087).—Capital, £1,000 in £1 shares. Return dated September 22nd, 1925. All shares taken up. £699 paid. £301 considered as paid. Mortgages and charges, nil.

Dartmoor Electric Supply Co., Ltd. (110,871).—Capital, £2,000 in 10s. shares. Return dated November 5th, 1925. All shares taken up. £2,000 paid. Mortgages and charges, £4,000 of 4½ per cent. first debentures; £3,950 of 6 per cent. second debentures (£3,550 held by bank as collateral security).

John Spencer, Ltd. (56,764). — Capital, £75,000 in £5 shares (10,000 preference and 5,000 ordinary). Return dated May 21st, 1925 (filed February 17th, 1926). 10,000 preference and 1,027 ordinary shares taken up. £55,135 considered as paid. Mortgages and charges, £25,000.

Herbert Smith & Jones, Ltd.—E. H. Smith, of 24, Sedgeford Road, Old Oak Road, London, was appointed receiver and manager on February 24th, 1926, under powers contained in debenture dated May 4th, 1925.

W. E. Booton, Ltd.—Mortgage dated February 22nd, 1926, to secure £3,000 charged on warehouse and premises, No. 3, Wanlip Street, and three messuages adjoining numbered 3, 5 and 7, Wanlip Street, Leicester. Holder: H. Pratt, Nicholas Street, Leicester.

Electrical Specialities Co., Ltd.—F. C. Young, of 45, Bank Street, Sheffield, ceased to act as receiver or manager on March 2nd, 1926.

Coates & Co. (Sheffield), Ltd.—F. C. Young, of 45, Bank Street, Sheffield, ceased to act as receiver or manager on February 28th, 1926.

W. J. Tough & Partners, Ltd.—E. J. Barnes, of 24, Cambridge Road, W.4, ceased to act as receiver or manager on October 21st, 1925.

Interchangeable Electric Signs, Ltd.—Particulars filed of £4,380 debentures, authorised February 26th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Underground Electric Railways Co. of London, Ltd.

Lord Ashfield presided at the annual meeting on March 11th, and in presenting the report and accounts said that an agitation had sprung up among the independent omnibus proprietors in opposition to the proposals of the Minister of Transport to restrict the number of omnibuses upon the streets of London. That was a matter of serious importance to men who had perhaps invested all their savings in their omnibuses. As there was no provision for compensation under the London Traffic Act, the Minister had suggested that omnibus owners should set up a voluntary fund from which assistance could be provided for those who suffered financial loss from the restrictive methods. The company was agreeable to participate in such a fund. The chairman then reviewed the past year's working of the companies in which the company was interested, including the North Metropolitan Electric Power Supply Co., stating that the income from investments had declined by £53,000. The total capital of the companies was now £66,430,000, and of this the public held 68 per cent. and the company and its associates 32 per cent. Dealing with the company's capital, Lord Ashfield referred to the fact that when the 4½ per cent. bonds and 6 per cent. income debenture stock were issued, with the interest paid free of tax, the income-tax was only 1s. in the £, whereas it was now 4s., apart from the disparity between the British and American exchanges which had occurred in the meantime. For 24 years £5,000,000 of the capital invested in the company had received no return whatever. He was prompted to believe, however, that there were better times ahead; the company was getting into a position in which the chances of a dividend were distinctly encouraging. The amount carried forward was £146,000, and it had grown slightly each year. The prospects of the subsidiary companies were growing brighter, and the conservative policy which had been followed in past years was beginning to bear fruit. They had to straighten several things out before they commenced paying an ordinary dividend, for once that was commenced they wanted to continue it. At the moment he had no definite capital reorganisation scheme to lay before them, but the matter was receiving serious consideration.

County of London Electric Supply Co., Ltd.

The balance available for 1925, after meeting all expenses and adding £74,399 brought forward, is £798,218. Debenture interest and sinking fund absorbs £72,795; £70,000 is carried to contingencies reserve; £150,000 is placed to reserve for depreciation, renewals, &c.; £335,000 is transferred to general reserve; leaving a balance of £170,424, to which is added £108,337 interest on share capital chargeable to "Barking Supply," making £278,761. After providing for preference and interim ordinary dividends, it is proposed to pay a final dividend of 10 per cent. on the ordinary shares (making 15 per cent. for the year), and to carry forward £24,098. The applications received during the year amounted to the equivalent of 25,187 kW in respect of general business and bulk and railway supplies, making the total at December 31st 166 394 kW. The amount of energy sold increased from 78,840,134 kWh to 93,845,622 kWh. The total number of consumers supplied directly or indirectly by the company shows an increase for the year of 8,391, and the total is now over 70,000. The report makes reference to the opening of the Barking station by H.M. the King; the issue of £2,000,000 of 6 per cent. cumulative preference shares; the passing of the London Electricity Supply (No. 1) Bill; the appointment of Mr. A. Page, M.I.E.E., as an additional director, &c. The meeting is to be held on March 23rd.

Para Electric Railways and Lighting Co., Ltd.

The report for the year ended November 30th last shows that the net revenue was £60,311, as compared with £33,664 in the preceding year. After deducting London expenses and debenture interest the result is a net profit of £17,354, as compared with a deficit of £11,209. During the year debenture interest payments were brought up to date; the sinking fund is still three years in arrears. The Para Municipality has sanctioned a revision of fares, and the outlook is said to be more hopeful.

British Insulated Cables, Ltd.

The directors' report for the year ended December 31st last records a profit of £670,000, to which is added £221,710 brought forward, making £892,010. After deducting directors' fees, debenture interest, preference and interim ordinary dividends, &c., and allocating £75,000 to depreciation and £333,333 to reserve, there remains a disposable balance of £358,251. As we have already reported, the directors recommend a final dividend of 5 per cent., and a bonus of the same amount on the old ordinary shares (making 15 per cent. for the year), and a dividend of 5 per cent. and a similar bonus on the new ordinary shares, leaving £224,918 to be carried forward. The directors state that the substantial increase in profit is due to a number of causes, including increased turnover, new plant and buildings, enhanced efficiency, and the satisfactory completion of some long-term contracts. Reference is made to the capitalisation of £333,333 of the reserve and its issuance in the form of ordinary shares as a bonus. The meeting is to be held in Liverpool on Monday next.

Brompton and Kensington Electricity Supply Co., Ltd.

The revenue account for 1925 shows a balance of £57,633, to which is added interest amounting to £347 and a balance of £4,982 brought forward, making £62,962. The payment of the interim dividends left £48,081, which it is recommended should be dealt with as follows:—To depreciation account, £4,463 (making £100,000); to reserve fund, £28,700 (making £58,700); final preference dividend, £270; final ordinary dividend at the rate of 10 per cent., free of tax (making 10 per cent., free of tax, for the year); carried forward, £33. The connections (35-W lamp equivalent) rose from 561,559 to 591,768, and the number of consumers from 9,389 to 9,723. The average price obtained per kWh fell from 4.91d. to 4.86d. Reference is made in the report to the reorganisation schemes. The meeting was to be held yesterday (Thursday).

Bristol Tramways and Carriage Co., Ltd.

The revenue for the past year amounted to £1,041,410 and expenses to £937,122. The net revenue, including the balance brought forward, is £108,925. Debenture interest and preference and interim ordinary dividends absorbed £65,510, and it is proposed to deal with the balance, £43,414, as follows:—Final dividend of 4 per cent. on the ordinary shares (making 7 per cent. for the year); £10,000 to reserve for contingencies and renewals; leaving £5,414 to be carried forward. The reserve fund now stands at £360,332. The receipts of the tramway department showed an increase of £16,413 and those of the carriage department one of £47,146. The number of passengers carried during the year rose from 91,484,503 to 99,846,603. The report refers to the death of Mr. H. F. Cooper, who had been with the company for 40 years, 25 as secretary. The meeting was to be held yesterday (Thursday).

Metropolitan Electric Supply Co., Ltd.

The report for the past year records a gross revenue of £732,842 and expenses amounting to £309,044, leaving net revenue of £423,798, as compared with £392,372 in 1924. To this is added a balance of £10,806 from the previous account and interest, &c., amounting to £26,074, making £457,678. From this £200,000 is placed to the depreciation and reserve account, and, deducting debenture interest, pensions fund provision, preference and interim ordinary dividends, &c., there remains £91,750. It is proposed to pay a final dividend of 8 per cent. on the ordinary shares (making 11 per cent. for the year, as in 1924) and to carry forward £11,750. The total connections increased by 13,780 kW during the year, bringing the total to 95,479 kW. £392,807 was spent on capital account.

Clyde Valley Electrical Power Co.

The report for the year ended December 31st last records a balance of profit of £291,741, to which is added £63,878 brought forward, making £355,619. After paying the preference and interim ordinary dividends, and transferring £90,000 to the contingency fund and £46,500 to the second preference share special reserve, there remains a balance of £145,369, which it is proposed to allocate as follows:—Final dividend on the 6 per cent. preference shares, £9,000; final dividend of 5 per cent. (making 8 per cent. for the year) on the ordinary shares, £53,250; writing off balance of 1924 share issue, £695; provision for altering and furnishing new offices and showroom, £15,000; carried forward, £67,424. The additional 25,000-h.p. turbo-alternator referred to in the previous report is about to be put into operation at Clyde's Mill. The construction work at the Falls of Clyde is progressing satisfactorily, and it is anticipated that the power stations will be in operation in about 12 months' time. A clause protecting the company's interests was obtained in the Glasgow Boundaries Act, 1925. The meeting is to be held on March 24th.

German Companies.

The *Elevated and Underground Railway Company*, of Berlin, states that the net profits for 1925 amounted to 8,800,000 marks, as compared with 6,110,000 marks in the preceding year. The dividend is increased from 5 per cent. to 7 per cent.

The *German Telephone Works and Cable Industry Company*, Berlin, reports that although the degree of activity in 1924-25 was not uniform, it was satisfactory on the whole. The accounts show net profits of 476,000 marks and permit of the payment of a dividend at the rate of 6 per cent. No distribution was made in the previous year.

The *Electro-Works Company*, which is owned by the Reich, states that the extension of the works was continued in 1925, and after the completion of the developments in hand the total capacity in Zschornewitz and Lauta will amount to 400,000 kW. The total production showed a satisfactory increase, while the mines turned out 3,800,000 tons of crude lignite. The net profits increased from 4,450,000 marks in 1924 to 5,000,000 marks last year, and the dividend is increased from 7 to 8 per cent.

The *Siemens and Halske Company* reports gross profits and balance forward amounting to 9,591,000 marks for 1924-25, as compared with 3,321,000 marks in the previous year. The net profits are returned at 8,894,000 marks, as against 2,649,000 marks in 1923-24. It is proposed to pay a dividend at the rate of 6 per cent. No distribution was made in the preceding year.

The *Electricity Company (late Schuckert)*, of Nuremberg, records receipts totalling 2,806,000 marks as against 1,088,000 marks in 1923-24, and a net profit of 1,979,000 marks, permitting of the distribution of a rate of 4 per cent. as compared with *nil* in 1923-24.

Belgian Company.—*Société Internationale d'Energie Hydro Electrique.*—This company issued during the week an advertisement, in compliance with Stock Exchange requirements, setting forth particulars of its constitution and objects. The latter are to found, acquire, operate, &c., transport or allied undertakings. It has important holdings in the Barcelona Traction, Light and Power Co., Ltd., the Mexico Tramways Co., Ltd., the Mexican Light and Power Co., Ltd., and the Société d'Electricité de la Région de Malmédy (Serma). It has an authorised and issued capital of 162,500,000 fr., in addition to 40,000 founders' shares of no nominal value.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Hopkinsons.—350,000 ordinary shares of £1 each, partly paid and fully paid, Nos. 350,001 to 700,000. 360,000 7 per cent. cumulative preference shares of £1 each, partly paid and fully paid, Nos. 1 to 350,000.

The undermentioned have been ordered to be officially quoted:—

Singapore Traction Co.—71,469 ordinary shares of £1 each, fully paid, Nos. 93,740 to 165,208, and 47,110 7 per cent. cumulative preference shares of £1 each, fully paid, Nos. 152,891 to 200,000.

Companies to be Struck off the Register.—The names of the undermentioned companies will be struck off the register at the expiration of three months unless cause is shown to the contrary:—

Blooms (Wireless), Ltd.
Broadcast Wireless Co., Ltd.
Car Electrical Service, Ltd.
Electricians, Ltd.
Expert Electrical Co., Ltd.
Magniphone Co., Ltd.
Manchester Wireless Installation Co., Ltd.
Wilton Wireless Co., Ltd.
Wireless Telephones, Ltd.

Imperial Tramways Co., Ltd.—After paying debenture interest and the interim preference dividend the balance available from 1925 is £14,686. The remainder of the 6 per cent. preference dividend is to be paid, £6,048 is transferred to the reserve for depreciation and contingencies, and a balance of £3,838 is carried forward. A dividend of 7 per cent. was received by the company in respect of its holding of ordinary shares in the Bristol Tramways & Carriage Co., Ltd., but the London & Suburban Traction Co., Ltd., was unable to pay any dividends. The meeting is to be held to-morrow (Saturday).

Newcastle and District Electric Lighting Co., Ltd.—After meeting debenture and loan interest, allowing £20,000 for depreciation, and adding £6,000 to general reserve, there is a net profit of £16,380 for the past year. To this is added £15,834 brought forward, making £32,214. The directors recommend the payment of a dividend of 7 per cent., leaving a balance of £15,544 to be carried forward. A further amount of £4,300 of the second mortgage debentures was redeemed and loans amounting to £2,994 were repaid during the year. Meeting: To-day (Friday).

Arbroath Electric Light and Power Co., Ltd.—The annual report states that the profits for the past year were £6,759, to which is added £1,212 brought forward making £7,971. The directors proposed to apply £2,000 to reserve and renewals fund, making the amount £24,500; to pay a dividend of 8 per cent. per annum on the ordinary shares; to pay an additional dividend of 1 per cent. on the preference shares, making 6 per cent.; and to carry forward to next year's accounts £1,654. The meeting was held on March 12th.

British Electric Transformer Co., Ltd.—The directors propose to pay the preference dividend of 7 per cent. for the two years ended June 30th, 1925. (Six months' dividend already paid.)

Notting Hill Electric Lighting Co., Ltd.—Final dividend of 10s. per share, free of tax, on the deferred shares, making 14s. for the year, as in 1924.

British Aluminium Co., Ltd.—Final dividend on the ordinary shares at the rate of 12 per cent. (making 10 per cent. for the year), and a bonus of 2½ per cent.

Chelsea Electricity Supply Co., Ltd.—The profit for the past year was £67,062 and the addition of the balance brought forward and interest makes a total of £76,854. Debenture interest and interim dividends absorbed £16,283 and it is proposed to deal with the balance (£60,571) as follows:—To reserve for renewals &c., £17,000; to reserve fund, £24,000; final preference dividend, £900; final dividend at the rate of 15 per cent. on the ordinary shares (making 12 per cent.), £18,539; carried forward, £132. The amount of energy sold rose by 561,013 kWh to 7,092,550 kWh. The report refers to the passing of the London Electricity (No. 2) Act and to the death of Major W F. Woods, a director, whose place has been taken by Mr. P. D. Tuckett. The meeting is to be held on March 24th.

Woking Electric Supply Co., Ltd.—The report for 1925, which was presented at the annual meeting on March 10th, showed a balance of £33,422; the addition of £1,963 brought forward made available £35,386. After meeting taxation and debenture interest and paying the dividends on the three classes of preference shares, there remained a balance of £24,546, which it was decided to allocate as follows:—To depreciation and renewals fund, £8,000; to reserve account, £8,000; to change-over account, £4,000; dividend of 10 per cent., free of tax, on the ordinary shares; carried forward, £1,825. The number of consumers rose from 3,218 to 3,451, and the lamps connected from 261,489 to 275,602. The report made reference to the death of Mr. J. Ashby, a director.

Tynemouth and District Electric Traction Co., Ltd.—The total revenue for 1925 was £46,123 and the expenditure (including £5,000 for renewals) was £39,450. To the balance is added £1,862 brought forward, giving £8,535. It is proposed to pay the 5 per cent. preference dividend and one of 10 per cent. on the ordinary shares, leaving £2,369 to be carried forward. Meeting: March 22nd.

Bruce Peebles & Co., Ltd.—The profit for 1925, including the balance brought forward (£9,141), was £58,131. It is proposed to transfer £5,000 to taxation reserve, £5,000 to depreciation reserve, and £10,000 to general reserve; to pay a dividend of 10 per cent. on the preference and ordinary shares and a bonus of 5 per cent. upon the latter (as in 1924); and to carry forward £8,655.

Tees Power Station Co., Ltd.—The company's profits for 1925 were £85,693, and the addition of £1,231 brought forward makes £86,924. After meeting debenture interest and transferring £20,000 to reserve, the directors recommend a dividend of 3¾ per cent., leaving a balance of £1,764 to be carried forward. The previous dividend was at the rate of 2¼ per cent. The meeting was held on Wednesday last.

Hastings and District Electric Tramways Co., Ltd.—The report for 1925 shows a profit of £11,430, to which is added £1,284 brought forward, making £12,716. It is proposed to pay a dividend of 2½ per cent. on the ordinary shares, to allocate £2,500 to depreciation and £500 to the reduction of the suspense account, and to carry forward £1,562.

County of Durham Electrical Power Distribution Co., Ltd.—A profit of £44,764 was made during 1925. Debenture and loan interest, &c., absorbs £12,542, and a balance of £2,119 from the last account is added, making £34,341. It is proposed to pay a dividend of 6 per cent. and to carry forward £2,242.

Alley & Maclellan, Ltd.—The preference shares are to receive their second half-year's dividend, but the directors do not recommend any distribution on the ordinary shares. £10,317 is allocated to depreciation and £12,332 is carried forward.

Western Union Telegraph Co.—A quarterly dividend of $2 per share has been declared. The company proposes to increase its capital by $5,000,000 in connection with the employés' stock subscription scheme.

Metropolitan-Vickers Electrical Co., Ltd.—A dividend of 8 per cent. is recommended on the ordinary shares, as in 1924. The meeting is to be held on March 23rd.

Stewarts & Lloyds, Ltd.—Out of the past year's profits the directors propose a dividend of 7½ per cent. on the deferred shares, as against 12½ per cent. in 1924.

Manila Electric Co.—A dividend of 50 cents per share has been declared on the common capital stock for the quarter ending March 31st.

Stocks and Shares.

MONDAY EVENING.

THE dividends and reports of the companies dealing with electricity supply and electrical power distribution in respect of the year 1925 may be considered as extremely satisfactory. The reports are now virtually all issued, the dividends announced and, in some cases, the meetings held. On all hands the tale is the same; increased demand, willingness on the part of the public to use the "juice"; opportunities that open up fresh developments in every direction. There are very few branches of industry in this country that command anything like the same amount of hopefulness as the electrical trade has done, and is doing.

The County of London Electric Supply Co., Ltd., increased its net revenue from £650,500 to £723,800, and again paid 15 per cent. dividend on the ordinary shares, the same rate as that distributed in each of the two preceding years. For 1926 the dividend will be limited to 10 per cent. on the shares, but the reserves are to be capitalised, of course, and parcelled out amongst the shareholders, dividends on such capital being duly paid. Shareholders who look for no diminution in their income are not likely to be disappointed. City of Londons are lower at 45s. 9d., Bournemouth & Poole went back to 60s. 9d. A few sixpenny falls occurred in other shares, amongst them being Clyde Valley at 29s. 6d. The Clyde Valley report shows that the revenue from sales increased last year about 3½ per cent., and the company retained a fair amount, the dividend on the ordinary shares being kept at 8 per cent., in spite of the extra capital now ranking.

The Newcastle & District Lighting Co., of course, has nothing to do with the Newcastle-upon-Tyne Supply Company, being confined to the city and a few suburban areas. The dividend of 7 per cent. is ½ per cent. higher than that of last year, and compares with 6 per cent. for 1923. The ordinary shares stand at 20s., and the Company's 4½ per cent. mortgage debenture stock at 80.

The Tees Power Station is a subsidiary of the Newcastle-on-Tyne Supply Company, and has increased its dividend from 2¼ per cent. to 3¾ per cent. The Company's 6 per cent. first mortgage debentures are quoted at 102. The Newcastle-on-Tyne Electric Supply Company repeats its previously paid 7 per cent. on the ordinary capital, now much larger than it was a year ago. The profits for 1925 were £701,700, or £41,000 higher than those of 1924.

The Eastern Telegraph Company has declared its usual dividend of 2½ per cent. tax free for the quarter, and the Eastern Extension Company the same. Both of these are the final dividends for the year. Eastern Extensions are ¼ down at 18, while Eastern ordinary shows no change at 177½. Westerns are dull at 17½. Anglo-American deferred is a little lower at 23½. A florin fall in Automatic Telephones reduced the price to 50s. Orientals are easier at 2 1/16. Weakness in Marconis reduced the price to 22s. 6d., the market failing to make any headway against the continual stream of sales which filters in from holders disappointed at the incessant sagging of the price. Radio common are 7½, the preferred 9½, and Canadian Marconis 4s. 4½d.

British Insulated ordinary at 3 3/16 have risen the fraction, and there has been substantial buying of the shares during the past few days. India Rubber shares are a little lower at 1 3/16, from which it might appear as though some of the proprietors had been selling their shares in order to apply for the company's 5 per cent. first mortgage debenture, issued at 93 and redeemable in 1936. The debenture stock is an excellent investment and pays—oddly enough—better interest on the money for the time being than the shares afford, though it is scarcely necessary to say that expectation looks for a higher dividend on the latter in the future. Small declines occurred in Siemens, Metropolitan-Vickers ordinary and Babcocks, owing to the fear of the threat of an engineers' lock-out being put into effect, although the latest news suggests a hope that it may not take place after all. British Aluminium are good at 39s. 6d., and Callenders strengthened to 3 9/16.

A prospectus has been circulated of a new issue of Electric Light and Power Extension capital of 8 per cent. cumulative preference shares in the Wareham Electric Supply Co., Ltd. Another of the same sort is the prospectus of the South Midlands and Berkshire Electric Light and Power Co., in which preference shares and debentures are offered. These are both parts of the same group of companies which we have criticised on previous occasions, the chairman of each being Sir Charles B. H. Soame, Bart. Investment should give the issues a wide berth.

Lord Ashfield, at the meeting of the Underground Electric Railways of London, caused disappointment by not outlining a scheme for the reorganisation of the Company's capital. The shares had risen on the anticipation that he would propound such proposals, but the prices, while reacting from the best, retain improvements on balance. His Lordship did definitely declare, however, his hope that next year there may be at last a dividend on the Company's ordinary and "A" shares. Metropolitans and Districts are both lower. The tramway issues hold their rises of last week, but have made no further progress. British Electric Traction has risen 5 points. Of the foreign shares, Brazilian Tractions are unchanged at 94. Para Electric Railways & Lighting shares have stiffened to 5s. on a report which shows the Company to have secured a profit last year of £17,300, against a loss of £11,300 in 1924.

Mexican Utilities are weak, the position in Mexico appearing to become worse instead of better. The various American Utilities, which underwent sharp falls in the New York panic of a fortnight back, have regained most of their declines. Rubber shares are higher, thanks to a recovery to half-a-crown per lb. in the raw product. The infusion of greater cheerfulness into the market, caused by this improvement, has not led to any great expansion of business. It may be said, in point of fact, that all markets in the Stock Exchange are suffering from want of public orders, the reluctance to deal being mainly due, of course, to the very unsettled state of affairs that prevails in too many directions at home and abroad.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1923	Dividend. 1924.	Price Mar. 15. 1926.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	13	14	60/9	−1/3	4 12 2
Brompton Ordinary	1	10	10	1¼	—	*5 18 6
Charing Cross Ordinary	1	14½	15	46/6	+9d.	6 9 0
do. do. 4½ Pref.	1	4	4½	17/-	—	5 5 11
Chelsea	1	12	12	2¼	—	5 12 11
City of London	1	15	15	45/9	−1/3	6 11 2
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	2⅜6	−6d.	5 8 6
County of London	1	15	15	60/-	—	5 0 0
do. do. 6 % Pref.	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/-	−1/-	6 1 9
do. 7% Pref.	1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	14¼	—	5 5 3
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	10	32/-xd	—	6 5 0
do. do. 6% Pref.	5		6	5⅝xd.	—	5 11 7
Metropolitan	1	10	11	39/6	—	5 11 4
do. 4½% Pref.	1	4½	4½	17/-	−6d.	5 5 11
Midland Counties	1	5½	6	21/6	−9d.	5 11 7
Newcastle-on-Tyne Ordinary	1	6	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	1⅞xd.	—	5 13 10
South London	1	15	15	2⅞	—	5 17 1
South Metropolitan Pref.	1	7	7	25/6	−9d.	5 9 10
Urban Ordinary				19/6	—	4 2 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	45/-xd.	—	6 13 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	29/-	—	5 10

Home Rails.

Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	,,	4	5	65	−1½	7 13
do. District	,,	3½	3½	45½	−½	7 13 10
Underground Electric Ordinary	10	Nil	Nil	2⅝	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	8/6	+6d.	Nil
do. do. Income	Bonds	6	6	97xd.	—	*6 3 9

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23⅝	−¼	6 7 0
Automatic Telephone	1	3	6	50/-	−2/-	2 13 0
Chili Telephone	5	6	5	5⅝	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6⅝	—	7 8 2
Eastern Extension	10	10	10	18	−⅛	*5 11 1
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 8
Globe Tel. and T. Ord.	10	10	10	16¼	—	*5 9 7
do. do. Pref.	10	6	6	10⅜	−¼	5 12 11
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	6½	45½	—	*4 13 5
Marconi		10	10	22/6	−1/3	8 17 10
Marconi Marine	1	10	7½	20/-	—	7 10 0
Oriental Telephone Ord.	1	12	12	2⅛	−⅛	*5 16 4
United R. Plate Tel.	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17⅜	−¼	*5 13 6

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3⅛	—	8 12 6
do. do. 2nd Pref.	5	6	6	2⅛	−⅛	11 3 2
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	122½	+5	4 18 0
do. do. 6% Pref.	,,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	94	—	5 6 5
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	90/-	96/-	103½	—	*4 11 9
do. do. Deferred	,,	129/5	129/5	127	—	*5 2 7
do. do. Deb.	,,	4½	4½	78	—	5 9 0
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/6	—	Nil
London United Tram. Deb.	Stock	4	4	48	—	8 6 8
Mexico Trams. 5% Bonds	—	5	5	60½xd.	—	8 5 4
Mexican Light Common	100	Nil	Nil	30½	−2	Nil
do. Pref.	100	Nil	Nil	61½	−3	Nil
do. 1st Bonds	—	5	5	68½	−1	7 6 0
Yorkshire (West Riding)	1	5	—	14/-xd.	−1/-	7 2 10

Manufacturing Companies.

Babcock & Wilcox	1	12	12	52/-	−1/9	*4 12 4
British Aluminium Ord.	1	5	10	39/6	+9d.	4 14 1
British Elec. Transformer Pref.	1	Nil	7	20/9	—	6 14 11
British Insulated Ord.	1	15	15	3⅞	+⅛	5 0 0
Brush Ord.	1	10	10	90/9	−9d.	7 12 4
Callenders	1	15	15	3⅝	+⅛	4 4 3
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/3	—	... ...
Edison-Swan	4/-	10	10	8/6	—	4 14 1
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	32/6	—	6 3 1
Enfield Cable, Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	5	5	19/6	—	5 2 7
do. do. Pref.	1	6	6	20/-	—	6 0 0
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
,, Ord.	1	5	7½	31/3	—	4 16 0
Henley	1	15	16	3⅜	—	4 8 3
do. 4½% Pref.	5	4½	4½	4½xd.	—	5 6 0
India-Rubber	1	5	5	1⅞	−⅛	*4 4 3
Johnson & Phillips	1	10	10	2¼	—	8 8 8
Met.-Vickers, Ord.	1	8	8	26/3	−9d.	6 1 11
do. Pref.	2	8	8	2⅛	—	6 11 8
Siemens Ord.	1	—	7½	80/6	−9d.	4 18 4
Telegraph Construction	12	20	10	20	—	*4 2 9

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price March 16th.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£45	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3¼d. to 3½d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			...
Grade I	per ton net.	£266	£2 inc.
Grade II	,, ,,	£186	...
Grade III	,, ,,	£102	...
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	½d. dec.
c ,, Tubes (solid drawn)	,,	1/- to 1/0½	...
c ,, Wire, basis	,,	10½d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£90	...
d ,, (Electrolytic) Bars	,,	£86	£1- dec.
d ,, ,, Sheets	,,	£14 5 10s.	...
d ,, ,, Wire Rods	,,	£76	£5/- dec.
d ,, ,, H.C. Wire	per lb.	9⅞d.	...
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/3	...
h Gutta-percha, fine	,,	6/6	...
h India-rubber, Para fine	,,	2/2½	1½d. dec.
l Iron Pig (Cleveland Warrants)	per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£32 15s.	15s. dec.
g Mercury	per bot.	£14 10s. to £14 15s.	5s. dec.
e Mica (in original cases) small	per lb.	3d. to 4/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2½	...
p ,, ,, wire	,,	1/3½	...
o Platinum	per oz.	£23 10s.	...
d Silicium Bronze Wire	per lb.	1/-	...
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£295 15s. to £298 15s.	£3 inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/5	2d. inc.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Recrystallisation of Electrolytic Iron.—The stamping and drawing of metal sheet into various, and sometimes rather complicated, shapes plays a very important part in manufacturing operations. Low-carbon steel or open-hearth iron sheets are usually employed commercially for this purpose, but electrolytic iron sheet has recently been advocated as a very suitable material for such operations. Preliminary annealing of the sheet prior to stamping or drawing is necessary; in addition, intermediate annealing between different stages in drawing, in order to remove the "work hardness" and enable the sheet to withstand the deformation of subsequent stages, must often be resorted to. As a bearing on this problem a study has recently been carried out by the Bureau of Standards of the recrystallisation temperature of cold-rolled electrolytic iron and open-hearth steel strip; the mechanical properties of the cold-rolled materials after annealing at various temperature intervals up to 700 deg. C. (1,290 deg. F.) were determined and the microstructural changes were studied. The results showed that the electrolytic iron sheet of the composition used was noticeably lower in its recrystallisation temperature than the open-hearth steel sheet which was compared with it. A marked recrystallisation was noted in severely cold-rolled electrolytic iron sheet after it had been annealed for half-an-hour at 500 deg. C., together with pronounced softening of the work-hardened sheet, whereas a similar change in the open-hearth steel sheet was not noted until after it had been annealed at 600 C. for half-an-hour. This difference in the recrystallisation temperatures of the two materials (100 deg. C.) may prove to be a factor of considerable importance in promoting the use of electrolytic iron sheet.—*Reuter's Trade Service* (Washington).

The Need for Statistics of the Electrical Industry.

By HARRISON DENT.

ADEQUATE statistics are essential to efficient production and marketing. The electrical industry, in common with most industries in Great Britain, lacks a central source of classified statistics. There are many bodies which carry out development work on behalf of sections of the industry, but as yet their activities have been confined to limited attempts at recording useful data and movements.

Recently the B.E.A.M.A. has been developing this work, the E.D.A. has attempted to carry out investigations in Great Britain, and the E.L.M.A. has fostered the use of electric lighting through researches. In addition, the ELECTRICAL REVIEW independently publishes and analyses data on foreign markets for electrical goods and on annual growth of electrical exports.

It would seem, however, that there is a need for a centralised bureau which should act for the whole industry, collect and classify data, issue reports on growth, and trend and carry out studies of home and foreign markets.

When we turn to U.S.A. we find that there is far more knowledge for trade consumption about the development of the electrical industry and about the markets for electrical merchandise.

Consider the home market for domestic electric appliances. It is obviously inefficient to advertise these goods in districts where electricity supply is lacking, very little developed, or too costly for the economical operation of common domestic appliances. It is equally inefficient to produce such appliances in quantity and to attempt to sell them in localities which constitute "unknown markets" in the sense that the degree of usage of electrical power and of electric domestic appliances is unknown, and the trend of growth uncharted.

If we attempt to apply engineering methods to marketing and distribution, and this surely is most essential, we shall look round for some gauge or yardstick which may indicate where the best market lies and where we should avoid setting up a distribution point.

In attempting to plan a scientific analysis of the market, we must obtain true indices; the number of supply authorities in a given area, the total private consumption of electrical power, the total domestic consumption of electrical power, the number of private consumers of electricity, consumption *per capita*, development programmes of the authorities, the number of electrical retailers, and the quantity of various electrical appliances sold per annum. These are figures which will tell us what we want to know about our market, and if we can obtain them over a period of years, we shall have valuable indices of growth and trend for each area considered and overall. Apart from this information purely relating to the industry, it is advisable to obtain data of a more general character concerning population, its classification, density, and distribution, and general indices of richness of the community such as rateable value per head of population, &c. Further essential data are the cost per unit of each supply undertaking for light and for power, and the local cost per therm or per 1,000 cubic feet of gas supply.

Given this collection of figures, we can analyse it and determine by logical means where the most favourable markets lie and where we should attempt to sell our merchandise.

We have arrived at a point at which we have tabulated the categories of desired data, and our search for these data commences.

Where are the data?

Much of this information is systematically collected by the Electricity Commissioners, and appears in their periodical reports.

Supply authorities are recorded also in "Garcke's Manual," in "The Electrician Annual Tables," and in "The Electrical Engineers' Year Book," and figures of consumers are most fully recorded at the back of the last-mentioned publication, although partially recorded in the other two publications. However, there are gaps in all of them, for it appears that certain supply authorities refuse to give these figures for public consumption, although the reason for this reticence is difficult to understand (if there is a reason).

All these available records must be combined and built up into figures which shall represent territory units, for they are not classified under counties. The total consumption for private supply is recorded in the *Electrical Times* supplements on supply authority results, but there is no separate record kept by companies of domestic consumption, and such records are not practicable universally. The only gauge of this factor is the load increase above normal, which supply authorities receive who have specially developed the domestic business.

Per capita consumption is an index of the degree to which electrical power is consumed by the individual consumer, and is more an index of industrial electrical development than domestic. However, it is logical to assume that in districts where the industrial load is very high, the cost per unit to the individual consumer is likely to be low, and hence the inducement to purchase on the part of the domestic consumer will be strong.

Records of electrical retailers in districts are contained in "The Electrical Engineers' Year Book." Concerning the quantities of various electrical appliances sold, this information cannot be gathered without employing the questionnaire system and circularising all retailers as to quantities, makes, and types sold. Given a good response to such circularisations, this method is most valuable to enable manufacturers and retailers to estimate the trend of consumption and taste throughout the country.

Statistics relating to the price of electricity and gas are of great value for competitive purposes. It is estimated by the E.D.A., after considerable test, that electricity can compete on costs with gas when the ratio of cost per therm to cost per kWh is about 8:1. In the instance of cost of gas being recorded in 1,000 cubic feet, the ratio should be about 30:1. These figures provide a guide from the view point of economical operation alone, and it is obvious that in instances when gas is slightly cheaper to use than electricity, the advantages of the latter as a form of power must outweigh the difference in cost.

It is admitted that apart from purely statistical considerations, an exhaustive study of any given locality should include a study "on the spot" to determine the local taste, local activities of electrical undertakings, &c., which will exert a bias on the conclusions derived from a purely mathematical analysis. However, this statement does not imply any doubt as to the value of such an analysis. The "local characteristics" study is a supplement and not a substitute.

We see that the work of securing these all-important data is considerable, for it involves reference to many sources, questionnaire methods, and the laborious compilation of numerous statistics into statistics representing counties or similar areas. This work forms part of an electrical development campaign, and is worth investigating by a central body for the benefit of the trade.

We have taken the domestic appliance field as one example, but the illustration is typical of the methods that could be applied to every other branch of electrical manufacturing and merchandising. For foreign

markets we need data on imports of the lines concerned, and on power development in a parallel manner.

The supply of useful data for gauging markets at home and abroad is carried out by many other bodies, the activities and resources of which are not fully appreciated. The Board of Trade, and that most useful and energetic department, the Department of Overseas Trade, work continually on behalf of the British manufacturer and trader. Import and export statistics for Great Britain and every other country are available for all British inquirers. Special information concerning agents and traders abroad, special studies of particular trades or commodities, reports on economic conditions abroad—these are a few of the manifold activities of the Department of Overseas Trade.

Another body which carries out a wide service for industry and trade is the Federation of British Industries. The *Bulletin* of the F.B.I., apart from its trade data, includes an economic forecast which is very valuable. Special reports on conditions abroad are a notable feature of the Federation's work, including foreign prices, activities of foreign competitors, methods of merchandising, local customs, and similar important information.

Again, there are libraries which contain essential data for the service of all who care to investigate. The Patent Office Library has a most exhaustive collection of technical works, and the British Museum Library contains a fine collection of reference volumes. Perhaps the least known, and yet most valuable of all libraries for many purposes is that of the London School of Economics. This remarkable library is open to any one who needs information, and its reputation abroad is, curiously enough, far higher than in Great Britain, where its huge resources are not generally appreciated. Special investigations are carried out by the staff of this library, and it contains many important volumes not obtainable in any other library in the country.

It is apparent that manufacturers and others who need information have sources to supply them with what they want, but the information is not centralised, and much time and labour must be spent to secure it. Each industry has special needs, and the value of the data that would be obtained would certainly justify the setting up of a research institution or body by the electrical industry, and its centralised nature would make for efficiency in operation. If the cost of upkeep were distributed over members of the industry, the cost to each member would be insignificant compared with the value of the work carried out.

While there is at yet no particular body in being which actually does carry out researches of the type indicated, the B.E.A.M.A. has already instituted a production index, and it seems that this body might be in a position to investigate market potentialities, distribution methods, &c., for the industry.

The whole question, embracing as it does manufacturing, distribution and selling, forms part of the wider category known as "Business Research." In U.S.A. this science, for it is incontestably a science, has been slowly developing, and we await the birth of a technique here as in other sciences and professions.

The application of scientific principles and methods to every process involved in the conduct of an individual business and of the industry of which it forms part may be new, but it is none the less desirable. We would be more correct in saying that it is essential. Of all the industries, surely the first to realise this must be the industry of engineers, and in this industry, the electrical engineering group should take the lead.

Conditions in South America.

Reports on Argentina and Brazil.

ARGENTINA.

Mr. H. O. Chalkley, C.B.E., Commercial Secretary to the British Legation, Buenos Aires, has presented a report (to September, 1925) upon the financial, commercial, and economic conditions in the Argentine Republic to the Department of Overseas Trade.*

In his introduction, Mr. Chalkley stresses the importance of the trade between this country and Argentina in which the latter State has the better share, the income from British investments being insufficient to redress the adverse balance against Great Britain. Mr. Chalkley says that if British exports have not benefited to the extent hoped for, it is not due to the state of trade in Argentina, or to diminished purchasing power, but to the prices of British goods and the greater intensity of foreign competition. In spite of divergences in most other aspects of trade, every agent and importer admits that it is easy to sell British goods when their prices do not exceed those of foreign products.

Electrical Imports.

It is stated that imports during the first half of 1925 remained at about the same level as in the first six months of 1924. The principal items, in their order of importance, were electric wire and cables, dynamos and motors, insulating tubes, electric batteries, battery materials, insulators, electrical material and accessories in general, and incandescent lamps. In electric wire and cables German and British manufacturers held the trade, the former leading slightly. Americans practically monopolised the market for batteries, which were principally of the automobile pattern. German manufacturers supplied over 50 per cent. of the dynamos and motors. In tubes British firms held the lead, followed closely by German suppliers who specialise in Bergmann tubing. British manufacturers were also the principal suppliers of battery materials—mainly for the British-owned railways. In porcelain insulators Germany secured 80 per cent. of the trade, while the lamps came principally from Holland and the United States. Electrical material and accessories in general were divided between German, American and British manufacturers. An appendix to the report contains detailed statistics of the electrical imports during 1923 and 1924. These show that in 1924 Great Britain made a considerable advance as a supplier of wire and cables and dynamos and motors.

*Stationery Office, 2s. 6d. net.

Power Developments.

The report says that some interest has been revived in the scheme for the utilisation of the Iguazu Falls, some 700 miles from Buenos Aires, on reports from New York that it is considered feasible to convey 300,000 h.p. from the falls to supply Buenos Aires with electricity at a cost not exceeding 60 per cent. of the present price. The cost of the scheme has been estimated at $50,000,000 (American).

The Government has granted the company supplying electricity to Buenos Aires a concession to reclaim land in the vicinity of the new port works for the purpose of erecting a projected new power station with a capacity of 500,000 kW. It is estimated that the consumption of coal at this new station will be 4,000 tons a day and it is proposed to install a pulverising plant.

Tramways.

The five tramway companies operating in Buenos Aires showed, in the aggregate, an improvement in receipts during 1924. The only company whose revenue declined was the Port and City of Buenos Aires undertaking. The receipts from the surface tramways during the first five months of 1925 showed a slight decrease, indicating that motor-omnibus competition is beginning to make itself felt. The delay in reaching an agreement between the municipality and the tramway companies has led to the postponement of active measures for relieving the traffic congestion of the city. Reference is made to the scheme of the Anglo-Argentine Tramways Company for the construction of two new subways, one from north to south, connecting the principal railway termini, the other connecting the centre of the city with the north-eastern suburbs. The invitation for tenders for the construction of a new electric tramway system for the town of Rosario failed to attract offers, and it is considered possible that tenders will again be invited in the near future. Motor omnibus services remain uncontrolled and continue to add to the traffic problem.

Communications.

The United River Plate Telephone Co. has now 310 exchanges, 136,044 subscribers, and 719,700 km. of lines. It estimates that £20,000,000 will have to be spent during the next 10 years to cater for development. Several long-distance lines have been installed recently and the Buenos Aires-Bahia Blanca line (1,600 km.) is to be inaugurated shortly. The automatic system is in operation in Buenos Aires, Cordoba and Rosario.

The international radio service carried on by the Transradio Internacional (a British-German-French-American group) worked without interruption during the year under review. A second long-wave transmitter was to be put into operation last September.

The country is badly served with broadcasting owing to a lack of co-operation between the interests concerned. The transmissions are inferior and spoiled by too much advertising. A recent decree fixed 190 metres as the maximum wave-length for amateurs, and a band of from 200 to 425 metres for broadcasting.

The Italian Submarine Cable Co.'s new cable, connecting Italy and Spain with Brazil, Uruguay and Argentina, was landed in Argentina in May last, and services were opened later.

Trading Methods.

Suitable agents to represent manufacturers are said to be extremely difficult to find, except in the rare cases where handsome remuneration is assured from the outset. Care should be exercised in the appointment of agents, and inquiries through the banks, the D.O.T., or the British Chamber of Commerce, are advised. It should be ascertained whether applicants for agencies have not already too many irons in the fire. With regard to the collection of payments, Mr. Chalkley says that many agents arrange for remittances to be made direct to their principals. Importers in general do not ask for more than 90 days' credit.

There are said to be many varieties of goods in which British trade is low owing to the lack of advertisement or the use of unsuitable advertising. Argentine customers are very receptive to careful and systematic advertising of branded goods backed up by judicious propaganda.

BRAZIL.

A report on the economic and financial conditions in Brazil up to September, 1925, has been prepared for the D.O.T. by Mr. E. Hambloch, British Commercial Secretary at Rio de Janeiro.*

Mr. Hambloch says that the political disturbances of recent months have had little effect upon trade. The bulk of the population takes little interest and no part in politics, and politics and trade are entirely divorced from one another. A favourable trade balance of £27,000,000 in 1924 was an indication of economic prosperity, though largely due to the exportation of coffee. Home producers are very well protected and the result has been an increase in the cost of living which has created serious problems. The continuance of stability is expected to lead to a gradual improvement in the exchange position; at the date of the report exchange was firmer than it had been for many months past.

Electrical Imports.

In the general report it is stated that Great Britain's share of the imports of electrical material and apparatus amounted to 14 per cent., the principal competitors in this trade being Germany and the United States. At the date of the report complete figures of imports during 1924 for the whole of the country were not available, but in an appendix statistics of importation at the port of Santos, supplied by the British Consul at Sao Paulo are reproduced. Although these represent only about 25 per cent. of the total trade they are said to be indicative of the nature of the whole. The imports of insulated copper wire totalled 190 metric tons in 1924 as compared with 362 tons in 1923, and Great Britain's share fell from 11 to 2 tons. Electric cable imports decreased from 407 to 253 tons, while the British share rose from 40 to 118 tons, ousting the United States from the first place. The imports of "apparatus for electricity and electric light" rose from 802 to 1,253 tons, and Great Britain's quota from 57 to 131 tons. Dynamos and generators increased from 222 to 381 tons (Great Britain 1 and 119 tons); electric motors from 909 to 905 tons (Great Britain 28 and 17 tons); and transformers from 662 to 770 tons (Great Britain 11 and 18 tons). The statistics show that Germany was the largest supplier of electrical goods, having contributed 1,483 tons out of a total of 3,802 tons representing the classes mentioned above. The United States supplied 1,168 tons and Great Britain 405 tons. The Acting Consul at Bahia reports that 370 cases of electrical material were taken into that port in 1924; of these 170 came from the United States, 108 from Belgium, 78 from Germany, and 17 from Great Britain.

Electrical Power and Development.

The British Consul at Sao Paulo (Mr. A. Abbott) says that owing to a long drought and the rapid increase in consumption the City and State experienced a severe power shortage. A contributory cause in some respects was the lack of foresight on the part of the Light and Power Company which supplied (at what may be termed an absurdly low figure) other public utilities with power which the company itself had to obtain from other power concerns at a much higher rate. New power stations are being constructed as quickly as possible, including one on the Serra do Mar, which will develop about 200,000 h.p. and will be the largest in South America, and there is no doubt that every effort is being made to remedy past errors. The fact remained, however, that practically all local factories were working (at the date of the report) only three days per week and the situation was daily growing more serious.

* Stationery Office, 2s. net.

The Acting Vice-Consul at Maranham (Mr. J. G. Clissold) says that good progress was made in 1924 by the American contractors to the State Government with the work of improving the town of S. Luiz do Maranhao. The lighting system was completed in July and the trams commenced running later. The American company takes 10 per cent. of the gross receipts from the tramway and lighting undertakings.

Among other developments a new sugar mill in the State of Alagôas is mentioned. This will have a capacity for crushing 1,250 tons of cane in 24 hours and will be electrically operated —an innovation in Brazil.

Railway Electrification.

There is an urgent necessity of electrifying the suburban portion of the Central Railway of Brazil, as under existing conditions it is impossible to increase either the number of trains or the number of cars in each train. The system is said to be from 100 to 150 per cent. overloaded at the busy hours of the day and accidents have been frequent. Plans for the electrification of the West of Minas Railway from Barra Mansa to Angra dos Reis have been drawn up. At August, 1925, the position as regarded electrification was as follows:—Completed: Campos de Jordao Railway (46 km.) and the Paulista Railway (70 km.) from Jundiahy to Rebouças. Under construction: Paulista Railway (24 km.) from Rebouças to Tatú. Projected: Paulista Railway (further extension to Barretos, 368 km.) and the Sorocabana Railway (104 km.). All these lines are in the State of Sao Paulo.

Trading Methods.

Mr. Hambloch puts forward a number of points for consideration by those desirous of trading with Brazil. In the first place, he says, it must be remembered that the language is Portuguese, but for business purposes it is more important that a commercial traveller should have a thorough knowledge of the articles that he wishes to sell rather than that he should be able to speak Portuguese. The visit of a representative of a firm wishing to do business with Brazil facilitates the task of finding suitable agents, but in the event of this being impossible, the D.O.T. is willing to render assistance. In the latter case very full particulars of commission terms, prices, credits, &c., should be furnished and a full range of catalogues (in Portuguese if possible) should be sent.

Many home firms have representatives in Brazil, but the number of local agents with technical training is very small. British goods still maintain their high standard of excellence, but the main difficulty is one of price and credit. It is well to remember that the Federal Government itself is the largest purchaser in Brazil of railway material and of plant for public works installations. Important contracts are also given by the various State and municipal authorities. The importance of adequate, influential, and competent local representation is therefore obvious. Long credits are necessary; there is scope for sound business to be done if the financing thereof (from the purchaser's point of view) be studied first. Many public contracts are given by calls for tenders; but even in these cases it is almost invariably too late for home manufacturers to think of presenting tenders if the first advice they have is the official announcement. The position of British suppliers of all classes of iron and steel goods, railway material, electrical installations of all kinds and public works generally in Brazil requires careful examination. Every effort should be made to find some solution of present difficulties, in order that the outlook for British trade in this class of supplies to Brazil may become generally as satisfactory as in the case of supplies to local British railways. The United States, Germany, Belgium, and France are active competitors.

Institute of Industrial Psychology.—We have received a copy of the annual report for the year 1925 of the National Institute of Industrial Psychology. The report contains a review of the five years' work of the Institute since its commencement. During the year in question the membership increased by over 60 per cent. and the payments received for investigations carried out by the Institute showed an increase of 10 per cent. An effort is being made to raise a fund of £100,000 to place the body on a permanent footing, and it is satisfactory to know that a considerable response is being received.

A Large Electric Winder.—What is claimed to be, from the dimensional point of view, the largest electric winding equipment in the world, is shortly to be installed at the City Deep Gold Mines, near Johannesburg, by the Metropolitan-Vickers Electrical Co., Ltd. The plant is designed to lift a net load of 9¼ tons from a depth of 4,500 ft. Thirty-one loads per hour will be delivered at the surface, and the winding speed will be 3,707 ft. per min., or more than 40 miles per hour. The maximum peak load for the driving motor will be 12,500 h.p., and the motor will operate at 32.7 r.p.m., being direct coupled to a bicylindro-conical drum of 35/17 ft. diameter. The Ward Leonard system of control is being adopted, d.c. energy being supplied by two 2,000-kW generators driven by a 5,200-h.p. induction motor. The double motor is nearly 20 ft. in diameter, with a bore of 16 ft., and weighs about 300 tons. The drum shaft weighs over 50 tons, while the drums themselves weigh about 350 tons and carry 18 tons of rope.

The Electricity (Supply) Bill, 1926.

Summary of Clauses.

The Electricity (Supply) Bill was introduced into the House of Commons on Wednesday, last week, by the Minister of Transport, and was published on Friday.*

The following is a summary of the principal clauses of the Bill:—

Constitution and Powers of Central Electricity Board.

There shall be established a Central Electricity Board, consisting of a chairman and seven other members appointed by the Minister of Transport, who shall hold office for not less than five years, and shall be paid salaries determined by the Minister of Transport.

The Board will be charged with the duty of supplying electricity to authorised undertakers, but shall not, save as expressly provided, generate electricity; it may, with the approval of the Electricity Commissioners, enter into arrangements with any authorised undertakers or other bodies for the exercise of any of its powers which can more expediently be exercised locally. The Board is to appoint consultative technical committees consisting of engineers employed in connection with selected generating stations, to give advice and assistance on such matters as may be referred to them.

Provisions as to Scheme.

The Board shall, as soon as practicable, prepare and submit to the Electricity Commissioners a scheme—

(*a*) Determining what generating stations (whether existing or new) shall be the selected stations at which electricity shall be generated for the purposes of the Board;

(*b*) Providing for interconnection, by means of main transmission lines to be constructed or acquired by the Board, of selected stations with one another and with the systems of authorised undertakers;

(*c*) Providing for such standardisation of frequency as may be essential to the carrying-out of such interconnection;

(*d*) Enabling or requiring temporary arrangements (to be in force during the carrying-out of the scheme) to be made between the Board and owners of generating stations (whether authorised undertakers or not) with respect to supplies of electricity, and to the working of generating stations (whether selected stations or not) by the owners thereof, upon such terms as in default of agreement may be determined by the Electricity Commissioners;

(*e*) Containing such supplemental provisions as may appear necessary.

A private generating station is not without the consent of the owners to be included in the scheme as a selected station, nor will the owners of such a station be required to enter into any temporary arrangements under the scheme.

The Electricity Commissioners are to cause the scheme to be published, and to give authorised undertakers and other persons interested an opportunity of making representations thereon, and after considering such representations, may confirm the scheme subject to such modifications as they think fit. As soon as the scheme is confirmed by the Electricity Commissioners it will be the duty of the Board to give effect to it.

The Board is to make arrangements with the owners of existing selected stations for them to be operated in accordance with the provision of the Act, and for such extensions and alterations as may be required: Provided that if the owners consider that any directions of the Board requiring extensions or alterations are unreasonable, they may appeal to the Electricity Commissioners, with a further right of appeal to the Railway and Canal Commission, against the decision of those Commissioners.

If the owners are unwilling to enter into or fail to carry out any such arrangements to the satisfaction of the Board, the Board is to be entitled to acquire the station at a price to be determined in accordance with the provisions of the First Schedule to the Act.

Where the Board acquires a station under this section, it may carry out such extensions or alterations as it thinks fit, and may either operate it or make arrangements with any authorised undertakers or other company or person to operate it: Provided that the Board shall not operate such a station unless it satisfies the Electricity Commissioners that it is unable to enter into an arrangement for its operation on reasonable terms.

The Board may make arrangements for the provision of such new stations as are required. If it is unable to enter into an arrangement with any authorised undertakers, company, or person for the provision of such new station on reasonable terms, the Commissioners may by a special order authorise the Board to provide the station, which may be operated by the Board if it satisfies the Commissioners that it is unable to enter into an arrangement for its operation on reasonable terms.

The owners of a selected station will be under the obligation to operate the station as the Board may direct, with due regard to economy and efficiency; and to sell to the Board all electricity generated at the station.

The owners of a selected station will be entitled to be supplied by the Board from that station with such electricity as they may require for the purposes of their undertaking, not exceeding the amount generated at the station.

The price to be paid by the Board to the owners of a selected station for electricity generated thereat is to be the cost of production, ascertained in accordance with rules contained in the Second Schedule to the Act.

The price at which electricity will be supplied by the Board from a selected station to the owners of that station will be either the cost of production, adjusted according to load factor, together with a proper proportion of the Board's expenses, or according to the tariff fixed under the Act for the supply of electricity by the Board, whichever is the lower.

If any question between the Board and the owners of a selected station arises under this section, it is to be determined by the Electricity Commissioners.

After a scheme has been confirmed as respects any area, the Board is to construct the main transmission lines required for the interconnection of selected stations with one another and with the systems of authorised undertakers in accordance with the scheme so far as it relates to that area.

Where a scheme provides for the acquisition of any main transmission lines belonging to any authorised undertakers, such lines shall, on payment of the price determined in accordance with the First Schedule, vest in the Board upon an order to that effect being made by the Minister of Transport.

The Board may require any authorised undertakers or the owners of any selected station to alter the frequency employed, if required to effect the standardisation of frequency provided by or under the scheme, or to effect such standardisation of frequency as the Board with the approval of the Electricity Commissioners may think expedient, subject to the payment of any expenses involved (including the cost of altering or replacing plant belonging to consumers). The Board may borrow for this purpose, but the resulting capital charges are to be excluded in assessing rateable value. The amount of the expenses incurred in carrying out any such requirement are in default of agreement to be determined by the Electricity Commissioners.

As soon as a scheme has been completed as respects any area, the Board will be under an obligation to supply to any authorised undertakers in that area demanding such a supply, such an amount of electricity as they require for their undertaking: Provided that the Board shall not supply electricity to authorised undertakers in the area of a power company without the consent of the company, or in the district of a joint electricity authority without the consent of the Electricity Commissioners.

Where it appears to the Board that the outlay incurred in providing the transmission lines required would entail unreasonable expense, the Electricity Commissioners may authorise the Board to impose terms and conditions on the giving of the supply.

Where any authorised undertakers owning a generating station, not being a selected station, demand a supply of electricity, the Board may make it a condition that they shall take the whole of the electricity required for their undertaking from the Board: Provided that the cost per unit to the undertakers will be less than the cost at which electricity is then being produced at the generating station of the undertakers; and the latter may appeal to the Electricity Commissioners, whose decision is to be final.

The Board may, before the carrying-out of the scheme in any area is completed, supply electricity to undertakers in that area.

The price to be charged by the Board for electricity supplied to authorised undertakers is to be in accordance with such tariff as may be fixed by the Board from time to time, so that the receipts shall be sufficient to cover the expenditure, including interest and sinking-fund charges, with such margin as the Electricity Commissioners may allow. The tariff is to show separately (*a*) a fixed charges component; and (*b*) a running charges component, and may be different for different areas.

Where any authorised undertakers take a supply of electricity from the Board, the price charged by them for the supply of electricity in bulk to any other authorised undertakers is to be on the same terms, together with such charges in respect of any transmission line used for the purpose as are mentioned in the Third Schedule; any question as to the amount of the price is to be determined by the Electricity Commissioners.

Where the owners of a selected station who take a supply of electricity from the Board prove to the satisfaction of the Commissioners that the cost of taking that supply in any year during the first seven years exceeds the cost which they would themselves have incurred in generating the like quantity of electricity, the charges will be so adjusted that the amount charged in that year does not exceed the cost which the undertakers would have incurred.

Where the Board notifies to any authorised undertakers owning a generating station, not being a selected station, that

* H.M. Stationery Office, Bill 59. Price 9d. net.

it is in a position to supply the whole quantity of electricity required for their undertaking on specified terms, and is satisfied that the cost of the supply on those terms is below the then prevailing cost to them, and they refuse to take such supply from the Board, then, if the Electricity Commissioners are satisfied as respects the next subsequent year that the cost of production of electricity generated by those undertakers substantially exceeded the cost they would have incurred had they purchased electricity from the Board on the specified terms, the Commissioners are to require the undertakers to make an abatement from the charges for electricity for the ensuing year equal to the amount of such excess.

Where any such undertakers have so refused to take a supply from the Board, it will not be lawful for them subsequently to increase their charges for electricity without the consent of the Commissioners. In calculating for this purpose the cost of production, no account is to be taken of capital charges in respect of the generating station.

The provisions of previous Acts relating to compensation for deprivation of employment are to apply to any officer or servant of any authorised undertakers affected by the closing or the acquisition of a generating station under or in consequence of this Act, as set out in the Fourth Schedule. The powers of authorised undertakers are extended to enable them to carry out arrangements with the Board notwithstanding any existing limitations.

Where the carrying-out of any scheme or arrangement would involve any operation for which the consent of the Minister of Transport or the Electricity Commissioners would be necessary under the Electricity (Supply) Acts, nothing in this Act is to relieve the Board or any authorised undertakers or persons concerned from the necessity of obtaining such consent.

Subsidiary Provisions as to the Board.

The Board is to be deemed to be an undertaker within the meaning of the Electricity (Supply) Acts, 1882 to 1922, but the provisions which relate to the purchase of undertakings by local authorities are not to apply to the undertaking of the Board. The Board is not to supply electricity directly to persons not being authorised undertakers, except the owners of selected stations, not being authorised undertakers, and, with the consent of the Electricity Commissioners, any company, body, or person requiring a supply for power purposes in any area not forming part of the area of supply of any authorised undertakers.

The Board may acquire land or rights over land voluntarily or compulsorily for the purpose of its powers and duties under this Act (including the construction of main transmission lines) like a local authority which is an authorised undertaker.

The Board may, by agreement with any authorised undertakers or other persons, use any main transmission lines upon such terms as may be agreed.

The Board and any company or person producing electricity by water power, waste heat, or otherwise, may enter into arrangements for the purchase of any surplus electricity which may be available, and may be authorised by the Commissioners to exercise such powers as may be necessary for the purpose.

The Board will annually make to the Minister of Transport a report of its proceedings under this Act, and furnish to the Electricity Commissioners such statistics and returns as they may require.

Financial Provisions.

All sums received by the Board will be paid into a separate fund, out of which the salaries of the members and the servants of the Board, and all expenses incurred by the Board will be paid.

The Board may, with the consent of the Electricity Commissioners and subject to regulations to be made by the Minister of Transport with the approval of the Treasury, borrow money, and the regulations may empower the Board to borrow temporarily by the issue of bonds or otherwise, and to make arrangements with bankers, and may apply any enactments relating to borrowing by local authorities.

Such powers of borrowing may be exercised for:—

(*a*) The construction or acquisition of main transmission lines, generating stations, and other works;

(*b*) Any other payment or any work the cost of which ought in the opinion of the Electricity Commissioners, to be spread over a term of years (including the payment of interest on money borrowed for capital expenditure for the period during which the expenditure remains unremunerative);

(*c*) The provision of working capital;

(*d*) Any other purpose authorised.

Any money borrowed under this section, and the interest thereon, may be charged on the undertaking and all the revenues of the Board, and must be repaid within such period not exceeding sixty years as the Electricity Commissioners may determine. The maximum amount which may be borrowed by the Board under this section is thirty-three and a half million pounds.

It will be lawful for any annual provision for the repayment of borrowed money to be suspended whilst the expenditure out of such moneys remains unremunerative, but such suspension must not be for a longer period than five years.

The Board may issue stock (to be called "Central electricity stock"). All such stock, and interest thereon, will be charged on the undertaking, and on all the revenues of the Board.

The Treasury may guarantee the payment of the interest and/or principal of any loan proposed to be raised by the Board, not exceeding thirty-three and a half million pounds. Such sums as may be required by the Treasury for fulfilling any guarantees given under this section will be charged on and issued out of the Consolidated Fund of the United Kingdom or the growing produce thereof. The repayment to the Treasury of any sums so issued, with interest thereon, will be a charge on the undertaking and all the revenues of the Board.

The Board is to prepare an annual statement of accounts, which is to be audited by auditors appointed by the Minister of Transport, and must be published.

Miscellaneous Provisions.

On a power company commencing to receive a supply of electricity from the Board, the Minister of Transport may revise the maximum prices authorised under the special Act of the company to be charged by the company for supplies, other than supplies in bulk to authorised undertakers, and may revise the standard prices fixed by such Act, and on such revision regard is to be had to the benefit to the company of any reduction in the cost of electricity due to this Act.

Where a special Act authorises such a company to make good any deficiency in previous dividends, the Commissioners may, after such inquiry as they think fit, by special order make provision for the repeal or limitation of any such authorisation.

Where any company, being an authorised undertaker and not being a power company, receives a supply of electricity from the Board, the Commissioners may by a special order make provision as to the relation between the charges to be made for electricity, and the dividends to be paid by the company. The provisions of this section are not to apply to any London company.

Where any tree interferes with the working of any electric line owned by authorised undertakers, the latter may give notice to the owner or occupier of the land on which the tree is growing, requiring the tree to be lopped. If objection is raised, the Minister of Transport, after giving the parties an opportunity of being heard, may make an order in that behalf, and determine whether compensation is to be paid.

Amendments of the Electricity Supply Acts.

Section 5 of the Electricity (Supply) Act, 1919, is replaced by a new Section regarding the constitution of electricity districts and the organisation of supply; and provision is made for the execution of works by joint electricity authorities, and for the delegation of powers to committees.

The power under section seven of the Electricity (Supply) Act, 1919, is to include power to constitute a joint electricity authority in any case where the original order did not do so.

Where, after the commencement of this Act, a special order is made authorising a company to supply electricity, and the area of supply includes the districts of two or more local authorities, the purchasing authority may after fifty years, or such shorter period as may be specified, and after every subsequent period of ten years or less, require the company to sell its undertaking upon the payment of the capital expended, less depreciation. The Minister of Transport will determine any questions which may arise in relation to such purchase.

The purchasing authority, where the area of supply is situate wholly or mainly within the district of a joint electricity authority, will be the joint electricity authority; or in any other case, the local authorities, acting through a joint committee or joint board.

The special order in any case to which this section applies may make provision as to the relation between the price charged for electricity and the dividends paid by the company.

Where a company, being an authorised undertaker, has ceased to generate electricity, and is taking a supply of electricity in bulk, and the undertaking is purchased by a local authority the purchase price is to include a sum representing the capital properly expended upon plant and other assets rendered unsuitable for use by reason of the taking of such bulk supply, less depreciation. Any question arising under this provision is to be determined by the Electricity Commissioners, whose decision will be final.

The charge made by authorised undertakers to any ordinary consumer, may, if duly authorised, consist of a periodical fixed or service charge, and a charge for the actual quantity of energy or electricity supplied to the consumer. The fixed charge may include rent in respect of any meter, lines, and appliances provided by the undertakers on the premises of the consumer, whether let on hire or hire-purchase terms or otherwise. A method of charge as aforesaid may be authorised by Special Order or by an approval under the Electric Lighting (Clauses) Act, 1899, or corresponding provision, and an option to ordinary consumers to be charged by an alternative method may be authorised.

The Schedule to the Electric Lighting (Clauses) Act, 1899, is to have effect subject to amendments specified in the Fifth Schedule to this Act. Minor amendments are specified in the Sixth Schedule to the provisions of the Electricity (Supply) Acts, 1882 to 1922.

For the purposes of this Act the expression "authorised undertakers" includes a joint electricity authority.

Schedules.

Seven Schedules are appended to the Bill. The first contains provisions as to the acquisition of generating stations and main transmission lines; matters in dispute are to be determined by an arbitrator appointed by the Minister of Transport.

The second Schedule gives rules for determining the cost of production of electricity at selected stations, and the third relates to authorised charges and allowances in respect of transmission lines used for giving bulk supplies to authorised undertakers.

The fourth Schedule adapts Section 16 of the Electricity (Supply) Act, 1919, as amended by Section 21 of the Electricity (Supply) Act, 1922, in respect of compensation to employés at generating stations closed or acquired by the Board.

The fifth Schedule amends the Schedule to the Electric Lighting (Clauses) Act, 1899, with regard to the disposal of the net surplus remaining in any year, and provides that the amount which may be carried to the credit of the local rate in any year shall not exceed one-and-a-half per cent. of the outstanding debt of the undertaking.

The sixth Schedule contains minor amendments of the Electricity (Supply) Acts, 1882-1922, and the seventh gives rules for determining the fixed charges component, and the running charges component.

The number of kilowatts of maximum demand is to be deemed to be twice the largest number of units of electricity supplied from the generating station during any consecutive thirty minutes in the year of account.

The West Midlands Electricity District.

The First Meeting of the Joint Electricity Authority.

THE establishment of the West Midlands Electricity District has been accomplished by the Electricity Commission, which summoned the first meeting of the Joint Electricity Authority for the area at Wolverhampton on March 10th.

The constituent bodies are represented on the J.E.A. in the following order: The municipal corporations of Lichfield and Shrewsbury, one member each; Walsall, two members; West Bromwich, two members; Wolverhampton, four members; the urban district council of Cannock, one member; Midland Electric Corporation for Power Distribution, Ltd., five members; the L.M. & S. and Great Western Railway Companies, one each. Other company undertakers (Cannock Chase Colliery Co., Ltd.), one member; the workers in the industry and colliery owners in the district, one each, while three other corporations, 21 urban and 13 rural district councils, are represented by two members.

Speaking at the first meeting of the J.E.A., Sir Harry Haward, an Electricity Commissioner, was confident that the J.E.A. would be able to co-operate successfully with the Central Electricity Board that was proposed by the Government. The district with the electrical development of which it was charged extended from Birmingham to the Welsh border, with an average width of some twenty miles; its area of 930 sq. miles contained 860,000 people, or 924 to the sq. mile. The electricity sold in 1925 amounted to 119,000,000 kWh, or 138 kWh per head of population. Calculations of Lord Weir's Committee were based on an average output of 500 kWh per head for Great Britain in or about 1940.

Potentialities of electrical development in such a district as that were great. The curve of maximum demand took for granted expansion in the immediate future, the aggregate maximum demand in 1930 being estimated at upwards of 90,000 kilowatts, as compared with 60,750 kW last year, or a 50 per cent. increase in five years.

The Committee's report indicated the nature of the work that lay immediately before it, which comprised: Taking over the control and operation of the generating stations and main transmitting lines belonging to four municipalities (Wolverhampton, Shrewsbury, West Bromwich, and Walsall), and of the Midland Co., with consequential reorganisation and necessary extensions of those stations; the construction of linking-up transmission lines and preparation of detailed plans for a new large generating station at Ironbridge with main transmission lines connecting it with the centres of demand of the district.

The District Orders and Acts of Parliament under which the J.E.A. would function, armed it with all the necessary financial and executive powers, subject to the consent, or approval, of the Commissioners. Generally the Order followed the usual form.

Sir Harry proceeded to refer specially to section No. 12, providing for the transfer of generating stations and main transmission lines, and to the significance of the fact that the terms of transfer had already been agreed. That was, perhaps, the outstanding example of the spirit of co-operation and goodwill which had so clearly manifested itself throughout the course of events in that district.

Sections 16 and 17 were important in that they gave effect to an essential feature of the technical scheme—the exclusion from the district of the area of supply of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. The Joint Authority was thus left with the sole responsibility for the supply of electricity throughout the whole district outside the areas of the authorised distributors. Financial clauses dealt with the borrowing of money up to a maximum amount of £5,000,000, but before putting in hand important works, the J.E.A. would naturally desire to be reasonably assured that such works would not conflict with, or be rendered unnecessary by, the Central Board's scheme when prepared and approved.

Sir Harry did not think it need have any hesitation on that score, and said the Commissioners would be prepared to assist it with advice from time to time as regarded each specific work; and the J.E.A. might take it that they, in giving their consent to any such works, would be guided by their knowledge of the probable working out of the general scheme.

Councillor J. Bell (West Bromwich) was elected the first chairman of the Joint Authority and Mr. G. R. J. Parkinson (chief engineer, Midland Electric Corporation for Power Distribution, Ltd.), vice-chairman, Mr. S. Topwith (Cannock Chase Colliery Co., Ltd.) having withdrawn from nomination. The Town Clerk of Wolverhampton (Mr. F. E. Warbreck Howell) was appointed temporary clerk to the Authority.

New Electrical Devices, Fittings, and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

Induced Current Cooking.

We witnessed recently a demonstration of cooking on new apparatus about to be introduced by the FALKIRK IRON CO., LTD., at its London showrooms, Craven House, Kingsway. The principle employed is that of the ordinary commercial transformer, the secondary winding actually being, in the case of boiling and frying operations, the cooking receptacle, which is constructed as a one-turn coil, carrying a very heavy current at a very low potential (1.25 V). For roasting, the joint forms part of the secondary circuit, special flexible contacts being provided for the inlet and outlet at the top and bottom of the joint. We reserve our comments on the constructional details of the apparatus until a later date, when we hope to be able to illustrate and describe the system. Some excellent cooking results were obtained; a quart of milk was brought to the boil from cold in 2 min. 10 sec., at a loading of 3,700 watts, at which load two quarts of water were boiled in 4 min.

A "Magnetic" Tee Square.

A new tee square, the Axene, introduced by Messrs. AXENE, LTD., Maxwell House, Arundel Street, London, W.C.2, should prove a valuable addition to the drawing office. This drawing instrument is similar to the ordinary tee square, except that in place of the usual ebony edge at the head it is provided with a special stainless steel magnetic edge. It is intended for use with a drawing board fitted with a steel edge at the appropriate side, so that the tee square is held in position by virtue of the magnetism. It is claimed that the instrument slides smoothly when desired, and yet permits the use of set squares without the necessity of holding the tee square.

A Small Generating Plant.

The accompanying illustration, fig. 1, is of a 120-W, 12-V generating set, a production of Messrs. STUART TURNER, LTD., 43-47, Market Place, Henley-on-Thames, which was originally designed for the Post Office telephone service for use in automatic exchanges in which over 150 of the sets are already installed. It should prove a suitable set for cottage or bungalow and yacht-lighting installations, and also for charging batteries for wireless and automobiles. The dynamo is of standard make and runs at 1,300 r.p.m.; it is used as a motor, driven from the battery, for starting the engine. This is a ¼-b.h.p. machine,

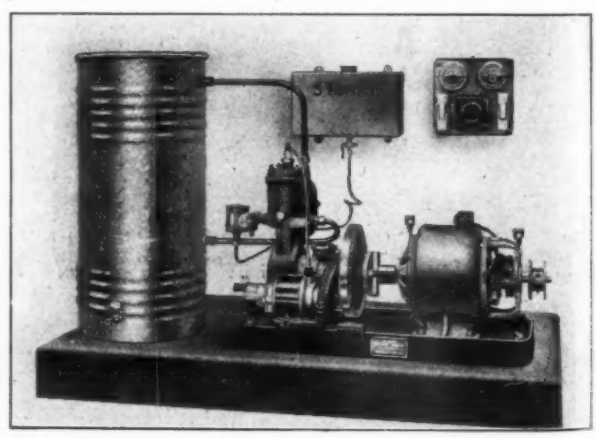


Fig. 1.—Small Generating Set.

designed for running on petrol, benzol or gas, and being completely enclosed, it is claimed to be gas-tight and clean; it is also claimed to be silent and very free from vibration, due to perfect balancing. The fuel consumption, petrol, is said to be a gallon for 10 to 12 hours' running. Starting is effected by means of a push-button on the switchboard, with the battery connected, a touch on the flywheel only being necessary to

help the engine over compression. Starting may also be done by means of a strap wound on the pulley at the end of the dynamo. The battery is of 50-Ah capacity; the cells are of glass with sealed lids and contained in a hardwood crate. The plant is provided complete with petrol and water tanks and the necessary pipes and foundation bolts.

An Improved Electric Cooker.

We have received from the HOTPOINT ELECTRIC APPLIANCE CO., LTD., 24, Newman Street, W.1, particulars of a new "Hotpoint-Falco." fig. 2, cooker (No. 5279-A). This is suitable for a household of 4-6 persons, and the hobplate carries two of the new "quick-service" boiling plates. These plates, the former of which is square, have the elements laid in troughs of circular design, and the elements are held in position by small lugs. The plate is of the semi-enclosed pattern, and is supplied with a grid cover which has a circular hole in the centre, exposing the coils when on medium heat, thereby giving a greater efficiency when a small utensil is being used. The plate is there-

Fig. 2.—"Hotpoint-Falco" Cooker.

fore enamelled on the underside to prevent flaking and rusting at that part, and it is made to be interchangeable with the company's existing boiling rings, and is fitted with a 3-pin plug-in connection. The spirals are of circular pattern and the former is in one piece. Ample provision is made for carrying away spilt liquids, &c., which are carried right through on to the crown plate of the oven, and this is easily cleaned. The two boiling rings and the separate grill are all controlled by separate 3-heat pointer-type reciprocating switches. It is not necessary to lift the hobplate to remove the boiling plates; they can be lifted and withdrawn without disturbing the cooker in any way, and it is therefore easy to replace them. The cooker has been adopted by a number of supply authorities.

An Electrically-Heated Food Trolley.

Among the many devices which afford the use of electricity for novel purposes is an electrically-heated food trolley, fig. 3, designed for hospital use, which is marketed by the DOWSING RADIANT HEAT CO., LTD., 91-93, Baker Street, London, W.1. It is a well made oak hot-cupboard with outside hinged doors on

Fig. 3.—Electrically-Heated Food Trolley.

one side, and a brass rail round the top. The interior is lined with asbestos, and suitable heating elements, with 3-heat regulation, are contained in the base. The whole is mounted on rubber-tired cycle-pattern wheels, 12 in. and 7 in. in diameter. The overall dimensions are 3 ft. 9 in. long, 2 ft. 1 in. wide, and 3 ft. 6 in. high. The loading is 1,000 W.

An Improved Flexible Cord.

We have received from MESSRS. WARD & GOLDSTONE, Frederick Road, Pendleton, Manchester, two samples of their most recent production, Negrolac flexible cord. It is intended to replace the usual workshop flexible cord, on which the wax compound with which the braiding is treated tends, in warm atmospheres or immediately above the lampholder, to soften. "Negrolac" is treated, under a special process, several times with a flexible oil and acid-resisting varnish, which, it is claimed, will not soften under the conditions named. The result is a smooth and bright appearance. The new product is made in two grades, one for pendant use, 23/36, in which the twin conductors, prepared to the I.E.E. rules, are coated directly with the "Negrolac" finish; in the other type, anti-shock, the insulated conductors are embedded in a soft flexible rubber over which is the "Negrolac"-treated braid.

Electro-Farming.

The Applications of Electricity to Agriculture.

THE meeting of the Institution of Electrical Engineers on March 4th, when a paper on the above subject (an abstract of which will be found in our issue of March 12th) was presented, was well attended.

Mr. R. Borlase Matthews, M.I.E.E., the author, taking his paper as read, showed a large number of lantern slides and two kinematograph films to illustrate methods of electric ploughing, the application of electric power and lighting on the farm, and agricultural processes. He also exhibited a selection of plants and bulbs in bloom and seedlings which demonstrated the influence which electric lighting had on their growth.

Discussion in London.

Sir A. DANIEL HALL, F.R.S., opened the discussion by remarking that they would need all the author's enthusiasm before they would reap much fruit. It was necessary to distinguish between the use of electricity on farms in this country and in Europe; on the one hand, its application to domestic purposes and small power by means of portable motors was normal on the Continent, and would be here also if they could have similar facilities for distributing electricity; however, that would only mean a small load. On the other hand, what prospect was there of inducing the farmer to change his methods of ploughing and of performing his major operations? They must beware of taking too rosy a view of the economy that would result from the adoption of electrical methods in such cases as those. Every farmer must use horses for cartage and odd jobs; that was a big operation, and the horses had to be kept employed when they would otherwise be idle. Steam ploughs had been available for many years, but they had not displaced horses; in fact, their use was decreasing rather than increasing, which facts indicated the need for a practical type of tractor. Following a reference to costing on a well-organised farm, Sir Daniel said that they were not yet certain about the positive results that were declared to result from the stimulation of plant growth by means of ultra-violet light, mercury-vapour lamps, electric discharge over crops, &c., and that, therefore, they could not begin to calculate the economics of the subject until they were definitely positive. Farmers did not care how they got their power so long as it was cheap and enabled them to carry out their operations economically. They were continually gambling with the weather, and therefore must move slowly and necessarily be conservative because they had no spare cash for experiments. Farmers had enough to do already, and accordingly it was the engineer who must do the pioneering. The farmer would have to be dealt with simply and directly, for he could not afford to adopt new methods until he was sure of them.

Mr. Ll. B. ATKINSON, pointing out that the engineer and farmer were largely ignorant of each other's point of view, said it was easy enough to get the farmer to use electricity when it was available. The real problem was how to take the supply into rural areas, and in that connection he agreed with the author's contention that statistics should be dealt with on a basis of route miles and not area supplied. For use in this country a smaller pattern of plough was more

suitable, but the plough was the wrong type of implement (except for horse haulage) and for high-speed work a lighter machine would be needed. The author had done a definite service in working out a concrete example of a transmission and distribution system. A large-scale experiment was needed now, but the farmer could not be expected to undertake it; he would have to be loaned the apparatus and equipment with an option to purchase it later. He agreed that if portable lamps, &c., were to be used, they must be properly specified in order to avoid accidents. He had found that, while the lighter kinds of poultry did continue to feed for longer periods under the influence of artificial light, the heavier breeds apparently took no notice of it, and went to sleep at the usual time soon after sunset; being heavier birds, they probably could eat more in less time. Although he did not question the stimulating effect of artificial light on plants, he pointed out the fact that all plants naturally grew more at night than in the day-time.

Mr. B. M. JENKIN explained that he used to be an engineer, but he commenced farming about 12 years ago. The author's conception of the total consumption of electricity if all farms in this country used it was too high, as his "57 million acres" included forests and other areas unfit for cultivation. He could not think that electric haulage was being used on any farm. The farmer's first object was to avoid useless expenditure. Were fixtures to be provided by the owner or the tenant? The farmer dare not put capital into fixtures when he might have to turn some of his land over to grass in a few years' time. The electric plough could not compete with the tractor, but rotary tillers involved a fundamental difference. More efficient means of driving the machines direct were required to take the place of the older horse-drawn implements which were provided with wheels that used the earth as a transmission belt.

Mr. W. FENNELL said the reason why more extensive use of electricity was made on the Continent was that electrical engineers in Europe were allowed to take their mains to the farmers with less hindrance and less stringent regulations than those encountered in England. His experience was that country people wanted electric light and would use it if they could get it; a modified form of "fringe order" was wanted, and an area extension order should be obtainable by specifying the area to be supplied instead of the individual. Increased facilities for running overhead lines were needed, and he appealed to those who had influence to help engineers to obtain that sort of assistance.

Mr. R. B. MATTHEWS, in reply to some of the points raised, pointed out that on his 640-acre farm he had two horses only, and they were not overworked, which fact showed that there were openings for mechanical operations. In America, where the artificial illumination of poultry houses was universal, it was found that the egg production from the heavier breeds of chickens was better than that of the lighter sort. Although ploughing was the traditional method of giving the farmer what he thought he needed, was it really the right operation that was wanted? In the past, farmers had been exploited somewhat by engineers, and they were consequently now diffident about the adoption of new methods.

The president, Mr. R. A. CHATTOCK, then adjourned the meeting.

The discussion was resumed on March 11th, when Col. K. Edgcumbe presided.

Mr. MONTAGUE FORDHAM, who has nearly completed a tour of some of the rural districts of the country, giving a course of about 300 lectures on rural construction, said it was felt in the places which he had visited that the future progress of the country districts depended on the use of electricity. As a reply to Sir A. Daniel Hall's remarks, he recommended the reading of Lady Hall's book, which dealt with rural reconstruction with special reference to electricity. The tendency of the people of the rural districts to leave for the towns would destroy civilisation, and electricity was essential to reverse the process. He found the farmers keenly interested in the use of electricity for agricultural processes, particularly in connection with hay drying.

Mr. F. H. CLOUGH said the difficulties in providing transmission lines were largely political. A serious item was the cost of switchgear for tapping the lines; at 3,000 V a cheap and simple equipment could be provided for loads up to 15 kVA. He recommended the laying of single-phase lines at first, to be followed when the load developed by 3-phase transmission, and suggested that it would be a drawback to include the capital charges of the lines with the consumption cost to the consumer; it would be better to charge the user an annual amount to cover the capital costs.

Mr. H. M. SAYERS referred to the question of lighting the hen-runs; he had recently carried out some experiments in this direction and had obtained an average of 3.27 eggs per hen during a period in the winter months. It was important to continue the lighting; after a cessation of only three days the egg production dropped from 130 to 90. He suggested that the heat absorbed by the condensing water in the generating station should be used for warming the soil used for agriculture. To do this a network of pipes carrying the warm water could be laid at a given depth and pitch in the ground. He estimated that a 10 deg. F. rise in the temperature of an acre of land would be equivalent to a 1,000-kW load. Besides warming the land it would defeat the spring frosts. This scheme would enable the market gardener to grow crops the whole year round; to hasten the growth, if slow, intensive lighting could be used.

Mr. E. B. WEDMORE criticised the method employed by Mr. Matthews of heating beehives. The proper method was to supply heat at the centre of the cluster. The bee itself, in its natural surroundings, consumed the honey from the centre of the hive and converted it into heat energy. His Association would welcome from Mr. Matthews any proposals for research on the question of the utilisation of electricity on the farm.

Col. R. E. CROMPTON referred to the proposed National Electricity Scheme; he thought the Prime Minister, when speaking of the saving to be brought about by the proposals, must have meant a saving as regarded agriculture. The industrial world was well served and not much could be saved by cheapening the supply. The young electrical engineer must address himself to the question of electricity supply to the rural areas and so reverse the process of the draining of the population into the towns. Only a large demand and even distribution could make a general rural supply possible. Electricity for lighting should be very cheap to encourage its use for power and other services, and this policy had been adopted in the districts around Milan, in the South of France, and recently in Germany. He would welcome any information as to the results of the production of nitrogen or nitrates in Germany. Some development of the hysteresis control referred to in the paper would probably result in a considerable advance in cultivation by means of electrical energy. He was afraid that the use of electricity on the farm would offer no advantage in diversity of load. He thought Mr. Sayers's scheme very attractive, but he did not see how it would be practicable when the generating station was 50 miles away from the land; if anything, the argument was in favour of the small station.

Major T. RICH paid a tribute to Col. Crompton; such energy and enthusiasm as were shown by the Colonel in the early days of electricity supply were wanted now to deal with the question of supplying the rural districts. In particular they wanted facilities for distribution. In France, where there were many thousands of miles of distribution lines, a committee of business men advised the Government on the question of transmission lines, and great facilities existed. The rural authorities had full powers to deal with the schemes, but they were not foolish enough to retard progress; they got something out of the schemes, as a small fee was paid to them. It was not the practice in France to employ 220 V on the farms; the general pressures used were from 90 to 110 V. In the north of that country 15,000 V was employed for general distribution and it was found that transmission at pressures above 3,000 V did not cost a great deal more. At Bethune 15,000 V was used on iron-wire lines. At the Grenoble exhibition last year a feature was double-stepping transformers for secondary pressures of 660 V and 110 V. He had noticed among the exhibits that the portable motors appeared to be no different to ordinary industrial motors. Developments were also shown in portable transformer stations. During the war the industries in Paris were encouraged by the electrical transmission schemes to move into the rural areas. It was regrettable that in this country they had to pay more for electric lamps than the people in any other country; they ought to be able to get lamps at 1s. or less each. A cheap lamp would do more to encourage the use of electricity than all Government stunts.

Mr. W. J. MINTON, in referring to some of the suggested methods for electric ploughing, said it must be remembered that the object of ploughing was two-fold, to turn over the ground and also to bury the weeds. Snatch crops were very desirable to the farmer and in this direction electricity would be a great help. He asked if Mr. Matthews had had any experience in the laying of tramlines over the farm, and also if he advocated the use of single overhead conductors with earth returns. No mention, he said, was made in the paper of the comfort of the farm labourer. If the farm hand was given a few lights in his own dwelling, he would soon be as enthusiastic about the use of electricity as the farmer. He did not agree that the farm labourer was not capable of the ordinary management of machinery; he knew of cases where the labourer took down the tractors and decarbonised them when necessary.

Mr. W. A. TURNBULL said that due to the influence of Mr. Matthews, the Aylesbury Council had just placed the necessary order for the electrification of the district. The scheme provided for overhead lines at 11,000 V and the cost was £600 per mile. At that pressure tapping off at any farm could be done with cheap apparatus; it would be difficult to do so at a pressure of 20,000 V. The main lines were to be of 0.075 sq. in. copper and the branch lines of steel wires. As the load developed the copper would be taken down and replaced by aluminium of double the capacity. The cost of the steel line was half that of the copper one. In order to overcome the injurious effects of the ammonia in the cow sheds to the wiring, he was advising the use of ordinary v.i.r. cables run on cleats.

Mr. R. H. WHITE suggested that consideration should be given to the generation of electrical energy for the country districts by wind-driven generators, which were being used to some extent in Germany.

Mr. A. H. ALLEN emphasised the necessity of cheapening the cost of distribution and of providing facilities for obtaining wayleaves for running overhead lines. The present difficulties experienced in obtaining the necessary wayleaves were a great drawback to progress in electrical distribution in the country areas. Every endeavour should be made to simplify the construction of overhead transmission lines. He felt that the elaborate devices which resulted from the present regulations

were undesirable. Quite recently a case had been reported where the protecting cradle of an overhead wire had been blown about in a gale and had knocked down the live wire itself, resulting in the death of a schoolboy who handled the wire. That was much worse than no protection at all. Many miles of overhead trolley wire were in use in the towns and very little trouble indeed was experienced with them.

Mr. A. E. JACKSON criticised the proposal to utilise the condensing water for warming the land on the ground that the heat would be required at night when the station load would be smallest. Referring to the cost of running out transmission lines, he quoted a case where the costs were only £180 per mile. This was effected by the use of a special reinforced concrete pole.

Mr. J. S. FRANCIS said that in Bavaria the rural supply companies did not care to undertake the distribution work and this was taken on by farmers' associations.

Mr. F. CREEDY asked for information as to what kind of electrical energy was used on the farm referred to in the paper. He had noticed that the frames of the motors shown on the slides were of the d.c. type. Although polyphase motors were preferable to motors of other types, single-phase transmission held many advantages over 3-phase.

In reply to a number of the points raised, Mr. Matthews said he welcomed the offer of Mr. Wedmore's association, and he would think it over. Referring to the question as to the production of nitrates he said that large quantities produced in Norway were sold to the farmers in this country. Electric ploughs should be considered as of two classes, the commercial type of to-day, worked on the same lines as the steam plough, and the prospective types embodying great improvements. The load and diversity factors of the farm were quite good, there being about 20 different branches in which the energy was used. Except for ploughing he was in favour of using no bigger motor than 5 h.p.; thrashing was a convenient odd-job load. In the Netherlands a steady load of 500 kW was taken by farms for thrashing. The ordinary industrial motor was used for agricultural purposes in France, but that country was farther behind than other countries in the production of agricultural types. As to the decrease in the number of steam ploughs in use in this country, that was due only to large areas of arable land having been turned to grass. The " powers that be " had an open mind on the question of overhead construction and would give careful consideration to any proposal that was put forward; many people were attempting to design lines in an amateur way. Continuity of supply in the rural areas was not of vital importance and the farmers generally were willing to put up with a greater voltage variation than the present regulations permitted. He thought it was a good practice to commence transmission schemes with steel wires and change over to copper lines when the load became profitable. By providing the farmer with the insulators and wires and letting him erect the lines, the capital outlay could be reduced to £25 per mile of line; there were more farmers capable of erecting lines than there were linesmen. It was not generally known that there were in existence two associations with official backing which would assist in schemes for rural construction. The Land Advance Corporation would advance loans for improvement schemes, including the introduction of electricity. The motors shown on the screen were a.c. motors with d.c.-type frames. Three-phase distribution seemed to be at present the most desirable method, but the transmission costs could be reduced considerably by redesigning apparatus for single-phase energy. A comparison between the night growths of two groups of plants in the same house with the same heat, but with different light, showed that the plants provided with intensified light made twice the progress of the others. The question of the price of electric lamps in this country had already been put before the Electric Lamp Manufacturers' Association. The Ministry of Agriculture and the School of Engineering at Oxford had recently completed some tests at Harpenden on windmills, and it was found that by using air-screw designed wings, as used for aeroplanes, the efficiency could be increased by 106 per cent. The use of the single wire with an earth return was receiving consideration in some quarters, and the system advocated by Mr. Seabrook would enable underground cables to be laid as cheaply as overhead lines at present. Electricity would prove a great help in inducing the people to get back to the land, but it must be remembered that electricity alone would not do it.

Legal.

Collins v. Southern Counties Electric Light and Power Supply, Ltd.

MR. JUSTICE LAWRENCE, in the Chancery Division on March 12th, had before him this action against the Southern Counties Electric Light & Power Supply, Ltd., of Bournemouth, for judgment in default of defence.

Mr. HECKSHER, for the plaintiff, said that the action was for the rescission of a contract to take debentures on the ground of misrepresentation, but on that day a defence had been delivered. In the circumstances, therefore, he could not ask for judgment on this application.

His Lordship said that the defence could not be disregarded, and he made no order.

Loughborough Corporation Summoned.

ARISING out of a recent fatality at the Empress Works, Loughborough, when a man named Arthur Hubbard was killed, the Loughborough Corporation was summoned at the local Police Court on March 11th. Two summonses, alleging that regulations had been neglected by leaving the terminal of a high-pressure cable insufficiently protected, were dismissed. A fine of £2 was imposed on a third summons, alleging that the Corporation had allowed an unauthorised person without proper supervision to undertake work where technical knowledge was necessary to avoid danger. On a fourth summons, for having failed to maintain in safe condition certain electrical appliances, a fine of £10 was imposed. Hubbard was engaged to repair the floor outside a cubicle, and being unaware of the danger, he put his head inside the cubicle and came into contact with a cable carrying energy at 6,400 V and was killed.

British Thomson-Houston Co., Ltd., v. The Novelty Co.

MR. JUSTICE LAWRENCE, in the Chancery Division on March 12th, granted an injunction on the *ex parte* application of the British Thomson-Houston Co., Ltd., restraining a company called the Novelty Company, of Grays Inn Road, W.C., from infringing the plaintiffs' patent for the gasfilled lamp.

Mr. TREVOR WATSON, for the plaintiff company, asked that the defendants should also be restrained from parting with the infringing articles.

His Lordship assented.

Leicester Corporation Fined.

THE Leicester Corporation was fined £100 at the Leicester Police Court on March 11th, for negligence at the Freeman's Meadow power station, as a result of which Andrew Wallace Minto was killed on January 27th. It was agreed that after deduction of the expenses of the prosecution, the balance should go to the relatives of the dead man. Minto was working a portable electric drill, which had no earthing wire attached to it, and he received a fatal electric shock. The Corporation accepted responsibility in law, and the chairman of the bench stated that someone had failed in his duty in not seeing that the regulations respecting the use of such tools were obeyed.

Theft of Motors.

AT Old Street on Saturday, Francis Leo Mooney, Upton Park, was charged on remand with stealing and receiving two electric motors, value £6, the property of his employers, the Enterprise Machine Supplies Co., Ltd., Whitechapel. Defendant pleaded guilty, and it was stated that he had borne a good character hitherto and the prosecutors did not desire to press the charge. Mr. Snell bound over defendant for twelve months.

Matton v. Pressland Electric Supplies, Ltd.

THIS case came before Mr. Justice Russell in the Chancery Division on March 9th, upon a motion by the plaintiff, the sole debenture holder in the company, for judgment against the company in default of appearance. Counsel in support of the application said there had been an issue of £6,000 debentures and the interest was in arrear. The minutes were in the usual form. His Lordship granted an order.

B.M.A.S., Ltd.

A PETITION for the winding up of this company came before Mr. Courthope Wilson, Vice-Chancellor, of the Lancashire Chancery Court, at Liverpool on March 8th. The petition was presented by the Chloride Electrical Storage Co., Ltd., creditor for £759. The defendant company was not represented, and an order for winding up was made.

Galliers v. Milward.

AT the Brighton County Court on March 11th, before Judge Cann, Mr. H. J. Galliers, electrical contractor, Worthing, sued Mr. A. Milward and his wife (trading as the Worthing Valet Service) for £56 19s. for work done and materials supplied. It was stated that £10 5s. had been paid into Court.

Mr. R. A. BULL, the plaintiff's Worthing manager, stated that Mr. Milward gave an order for an electrical installation at his shop in Warwick Street, Worthing. As the decoration had been completed and the work was required to be done quickly, witness suggested the use of lead-covered wiring and that was agreed to. The defendant saw the work in progress and made no complaint, and, later, gave instructions for the wiring of the upper part of the premises on the same system. Nor was any complaint received when the account was sent in.

Mr. A. J. HEDGCOCK (W. T. Henley's Telegraph Works Co., Ltd.), said that the system employed was safe, both electrically and mechanically.

Defendant, giving evidence, said that when he had had other premises wired, Mr. Bull had advised him that steel tubing was the only safe system. He had called attention to the use of lead-covered wiring on the installation in question, and Mr. Bull said that it had been used because it was less unsightly than steel conduit. When he found that lead-covered wiring had been used in the upper part of the premises he asked for it to be removed. Cross-examined, Mr. Milward said that he had had no cause to complain of the installation. He called a witness who, while stating that he considered

that the steel-tubing system was safer, admitted that he had had no experience with lead-covered wiring.

His HONOUR said that it was perfectly clear that the defendant wished to avoid paying a just debt. The plaintiff would be awarded £46 14s., in addition to the amount paid into Court, with costs on the High Court scale up to the date of remission and subsequently on Scale "C."

Explanation.—MESSRS. FERNAND ESPIR, of 68, Coleman Street, E.C.2, ask us to state, in order to avoid misconception among their trade friends, that they have no connection with the defendant in the law case "Bonnella *v.* Espir," reported on page 443 of our last issue.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Kent Coalfield. — On March 8th, Lord HENRY CAVENDISH-BENTINCK asked whether, when loans were made to those who were sinking the new coal pits in Kent, conditions were made for preserving as far as possible the amenities of the country side; whether smoke-abatement devices were insisted on at each pithead; and if conditions were laid down as to whether the pits were to be worked by steam or electricity.

Mr. MCNEILL, Financial Secretary to the Treasury, said that no conditions of the kind indicated were attached to the guarantee which the Treasury had agreed to give to Messrs. Pearson and Dorman, Long, Ltd., but a joint advisory town planning committee was watching the development of the area.

Severn Barrage Scheme.—On March 9th, Mr. WARDLAW-MILNE asked the Minister of Transport whether the committee which was to consider the possibility of the Severn barrage scheme would also be instructed to go into the possibilities of smaller power stations by harnessing the stream of the Severn at various points nearer its source in preference to the possible heavy expenditure on a great barrage at the mouth of the river.

Colonel ASHLEY said that on the recommendation of the Severn Barrage Sub-Committee of the Committee of Civil Research, the Government had decided to carry out certain preliminary investigations. When those had been completed the whole subject, including the points raised in the question, would be further considered.

The Electricity Bill.—On March 10th, the Government's Electricity Bill was introduced by Lt.-Col. Ashley, the Minister of Transport, and read a first time.

Mr. HARDIE asked the Prime Minister, in view of the interest manifested in the Electricity (Supply) Bill, whether he would see that ample time was given for discussion even if it should involve some curtailment of the holidays of the House.

Mr. BALDWIN said that the Government hoped to secure a second reading of the Bill before Easter in order that the fullest possible time might be available for its discussion during subsequent stages.

Electric Traffic Signs. — On March 11th, Captain BULLOCK asked the Minister of Transport whether he would consider the advisability of using electric and other signs where there was one-way traffic.

Col. ASHLEY said that the question of the erection of direction signs, capable of illumination at night, at one-way traffic streets, had been under consideration for some time, and arrangements were now in hand for the erection of such signs in Parliament Square, Long Acre, and elsewhere.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned:—

Tonalite (lettering and design). No. 466,202. Class 1. Electrolyte for accumulators.—A. J. A. de la Porte, 80, Schenkkade, The Hague, Holland. (British representatives: J. S. Withers & Spooner, 51-52, Chancery Lane, W.C.2.).

Guarding the Pole (lettering and design). No. 461,834. Class 8. Electric dry cells.—T. H. Poulsson, 43, Dronningensgade, Stavanger, Norway. (British representatives: Phillips', 70, Chancery Lane, W.C.2.)

Vita. No. 460,612. Class 8. Valves for use in radio-telegraphy and telephony.—Peter Curtis, Ltd.

Radiostar. No. 463,899. Class 8. Instruments, apparatus and parts thereof for use in radio-telephony and telegraphy, but not including detector crystals.—Edison Swan Electric Co., Ltd.

Rafex. No. 465,721. Class 8. Electron discharge tubes for radio and wired telegraphy and telephony, X-ray tubes not for medical or surgical purpose, and rectifying tubes.—Mullard Radio Valve Co., Ltd.

Emeer. No. 465,713. All goods in Class 13.—Metropolitan-Vickers Electrical Co., Ltd.

Varlina (lettering and design). No. 463,155. Class 8. Electrical apparatus for display signs or advertisements by means of illuminated or light reflective surfaces.—Harrington & Co., 47, Litherland Road, Bootle.

Becol, No. 466,434, and Becolite, No. 466,434. Class 8. Instruments and apparatus manufactured wholly or partly from ebonite or vulcanite.—British Ebonite Co., Ltd., 25, Nightingale Lane, Hanwell, W.7.

Davon. No. 455,936. Class 11. Electrical appliances for medical and surgical purposes.—F. Davidson & Co., 29, Great Portland Street, W.1.

Stabe-Lare (lettering and design). No. 463,958. Class 18. Electric arc welding plant.—Allen-Liversidge, Ltd.

Maconite. No. 464,448. Class 40. Preparations composed chiefly of india-rubber for insulating electric cables.—The Macintosh Cable Co., Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

19,824. "Electrical amplifying apparatus." J. W. Kirkland. (Allgemeine Elektricitats-Ges.). August 21st, 1924. (247,612.)

24,360. "High-frequency electric discharge tubes and generators for medical purposes." E. V. Hayes-Gratze. October 14th, 1924. (247,623.)

24,704. "Electrical system employing space discharge devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). October 17th, 1924. (247,626.)

24,793. "Electric cables." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. October 18th, 1924. (247,627.)

27,490. "Telephone systems." Automatic Electric Co., and C. E. Lomax. November 17th, 1924. (247,647.)

27,491. "Telephone systems." Automatic Electric Co. and J. Wicks. November 17th, 1924. (247,648.)

27,557. "Control of the effect of fluid currents on the stream-line surfaces of prime movers." Aero-Dynamos, Ltd. (Ventimotor Akt. Ges.). November 18th, 1294. (247,650.)

27,893. "Electrical measuring instruments." Crompton & Co., Ltd., W. F. Jones, and W. G. Smith. November 21st, 1924. (Addition to 233,808.) (247,663.)

27,918. "Electrical control systems." Metropolitan-Vickers Electrical Co., Ltd. November 28th, 1923. (225,542.)

27,931. "Laminated terminals for electric switches and the like." British Thomson-Houston Co., Ltd., H. Trencham, and L. Rigg-Story. November 21st, 1924. (247,665.)

27,936. "Electrical regulating apparatus for alternating current." E. H. Jones. November 21st, 1924. (247,666.)

27,961. "Thermionic valves and the like." Compagnie Générale de Télégraphie Sans Fil. November 21st, 1923. (225,234.)

27,981. "Switch plates." J. B. Tucker. November 22nd, 1924. (247,670.)

28,004. "Electric motor-starting and like switches." H. J. Norballe. November 22nd, 1924. (247,671.)

29,975. "Bracket for the detachable attachment of an electric fan to a wall or like surface." Veritys, Ltd., and H. W. Smallwood. December 13th, 1924. (247,693.)

30,632. "Sparking plugs for use with internal-combustion engines." M. Sacchi. December 19th, 1924. (247,698.)

30,716. "Coupling of magnetos of internal-combustion engines." F. H. Royce. December 22nd, 1924. (Cognate application 30,963/24.) (247,700.)

30,833. "Electric switches, plug-and-socket connections, and like electrical accessories, and the manufacture thereof." J. A. Crabtree. December 23rd, 1924. (247,702.)

31,326. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. December 31st, 1924. (Cognate application 6,604/25.) (247,711.)

1925.

1,534. "Water-turbines for electric generating stations." J. H. Vincent. January 19th, 1925. (247,718.)

1,598. "Brush-holders for dynamo-electric machines." English Electric Co., Ltd., and E. H. H. Hassler. January 19th, 1925. (247,719.)

2,467. "Electrical connector." W. E. Bottom. January 28th, 1925. (247,724.)

2,583. "Supports for wireless and like panels." W. H. Liles and J. K. Pennington. January 29th, 1925. (247,725.)

2,790. "Headlights for motor-cars, motor-cycles, and the like." A. M. Ure. January 31st, 1925. (247,726.)

3,165. "Sound amplifiers." H. Kanders. February 4th, 1924. (228,905.)

3,718. "Production of die-cast iron castings." E. W. Walford (E. Holley). February 10th, 1925. (247,735.)

3,777. "Acoustic amplifiers or radiators." E. A. Graham and A. J. Denniss. February 10th, 1925. (247,736.)

4,316. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), L. P. Lowry, and J. R. Gould. February 17th, 1925. (247,742.)

5,258. "Head-lamps suitable for use on motor-cars." G. Herbert. February 25th, 1925. (247,745.)

5,456. "Method of and means for increasing economy in long-distance cables." British Thomson-Houston, Co., Ltd. February 29th, 1924. (230,085.)

8,170. "Rectifying elements for high-frequency electrical oscillations." H. Wade. (Carborundum Co.). March 26th, 1925. (247,767.)

8,827. "Vacuum tube systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co.). (Western Electric Co., Inc.). April 2nd, 1925. (247,774.)

9,056. "Electrical contact devices." G. G. Bowen. April 4th, 1925. (247,777.)

9,203. "Device for electrically indicating whether a non-electric light has gone out or failed." A. Shaw and F. Fairier. April 7th, 1925. (247,779.)

12,146. "Insulators." M. Treve. November 12th, 1924. (242,942.)

12,158. "Crystal detectors." W. F. Harkness and F. Davies. May 9th, 1925. (247,794.)

13,785. "Electrical fuseholder." H. J. McCarthy. May 26th, 1925. (247,807.)

14,159. "Spark-gaps for induction coils and the like." F. E. Kewley and Bower Electric, Ltd. (in liquidation). May 29th, 1925. (247,809.)

14,684. "Ferraris electric meters." Soc. Genevoise d'Instruments de Physique. June 25th, 1924. (236,187.)

14,871. "Brakes for electric motors." Toledo Automatic Brush Machine Co. October 6th, 1924. (240,791.)

16,443. "Wrapping papers for cables." Felten & Gilleaume Carlswerk Akt. Ges. December 27th, 1924. (245,059.)

17,214. "Distributing transformer." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). July 4th, 1925. (247,824.)

17,660. "Variable air electric condensers." A. K. Croad (Amsco Products, Inc.). July 9th, 1925, ((247,829.)

17,826. "Carbons or electrodes for the formation of ultra-violet rays for therapeutical purposes." Dr. M. Arnone and V. Arnone. July 11th, 1925. (247,831.)

18,768. "Inductance and like electric coils, and mounts therefor." J. Bottomley and A. N. Riley. July 23rd, 1925. (247,834.)

19,717. "Electric ciphering apparatus." H. G. C. Fairweather (Aktiebolaget Cryptograph). August 5th, 1925. (247,838.)

19,927. "Electric drives for looms." Siemens Schuckertwerke Ges. August 8th, 1924. (238,247.)

20,070. "Electrical insulating devices." Metropolitan-Vickers Electrical Co., Ltd. August 14th, 1924. (238,545.)

20,460. "Electrotelephonic sound-box." H. Robeck and Fein-Maschinen-Bau Ges. August 14th, 1925. (247,843.)

21,157. "Alternating pole magnets for small size electrical machines." Fahrrad & Metallwerke L. Bauer & Co. Ges. October 8th, 1924. (241,166.)

24,059. "Electric contact device, particularly for use in electric clocks." Landis & Gyr Soc. Anon. October 28th, 1924. (242,244.)

24,285. "Automobile headlights." C. C. Ramsay. September 29th, 1925. (247,868.)

25,137. "Variable air electric condensers." A. K. Croad (Amsco Products, Inc.). October 8th, 1925. (247,874.)

26,097. "Electric condensers." P. R. Coursey and Dubilier Condenser Co. (1925), Ltd. October 19th, 1925. (247,881.)

26,776. "Method of operating high-speed switches for heavy currents." International General Electric Co., Inc. October 27th, 1924. (241,952.)

1926.

104. "Ignition apparatus for internal-combustion engines." F. H. Royce. November 17th, 1924. (Divided application on 247,304.) (247,897.)